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ABSTRACT

The functional design of the information system proposed for the Los Angeles Unified School District (LAUSD) is detailed in this report. The design specifies input data, processing, file formats, and report formats. The implemented system will provide information in four general areas: personnel, program/budget, educational results, and community profile. Many information needs are not specifically provided for because existing information systems serve these functions within the District. For descriptive purposes, the information system may be divided into five subsystems. Four provide data in the categories listed above; the fifth, an inquiry system, allows the decisionmaker to access all information reposited within the system. Each subsystem is described. (Other reports in this series are: LI 003908 through 003910 and LI 003912). (Author)

ED 068116

VOLUME 4

AN INFORMATION SYSTEM FOR EDUCATIONAL MANAGEMENT: Functional Design

John Farquhar
David Stewart
Jan Lombaerde

Prepared for the Los Angeles Unified School District

DECEMBER 1971
R-933/LACS

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Functional Design

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PREFACE

In response to community, legislative, and student pressures, school administrators have recently begun to examine the potential of modern management tools and practices. This search for techniques that might function effectively in an educational context led to the adaptation of such methods as program budgeting and accountability. Another tool frequently chosen for educational assistance is the modern management information system, a computer-based aid to planning and decisionmaking.

In late 1970, the Los Angeles Unified School District (LAUSD) contracted with The Rand Corporation to design such an information system in support of educational management. The system is specifically intended to aid planning and decisionmaking (through implementation of accountability and program budgeting) in schools partially supported by Title I provisions of the Elementary and Secondary Education Act.

This report is the fourth in a series describing the proposed information system. It details the system's functional design, specifying input and output data, file formats, and necessary processing. The series also includes:

- J. A. Farquhar and B. W. Boehm, *An Information System for Educational Management, Vol. I: Design Considerations*, R-930-LACS. Defines near-term information system requirements, design guidelines, major design constraints, and information needs of educational decisionmakers.
- M. L. Rapp, *An Information System for Educational Management, Vol. II: Data Requirements for Accountability*, R-931-LACS. Defines the future shape of the accountability system, and feasible long-term trends and requirements in the areas of research and evaluation.
- T. S. Donaldson, *An Information System for Educational Management, Vol. III: Data Requirements for Evaluation;*

A Review of Educational Research, R-932-LACS. Reviews and discusses the literature concerning student evaluation, providing direction for eventual information system growth.

- J. A. Farquhar, I. M. Iwashita, and S. H. Landa, *An Information System for Educational Management, Vol. V: A Design for Implementation*, R-934-LACS. Describes and discusses alternative hardware, software, and support configurations that might provide the desired services, and the costs and benefits of each.

- L. A. Dougharty and S. A. Haggart, *An Information System for Educational Management, Vol. VI: An In-Service Training Program*, R-935-LACS. Describes the education and training requirements for educational administrators charged with effective use of program budgeting, accountability, and the designed information system.

SUMMARY

This report details the functional design of the information system proposed for the Los Angeles Unified School District (LAUSD). The design specifies input data, processing, file formats, and report formats.

The implemented system will provide information in four general areas: personnel, program/budget, educational results, and community profile. Many information needs are not specifically provided for because existing information systems serve these functions within the District.

For descriptive purposes, the information system may be divided into five subsystems. Four provide data in the categories listed above; the fifth, an inquiry system, allows the decisionmaker to access all information reposited within the system. Each subsystem is briefly described below.

PERSONNEL INFORMATION SUBSYSTEM

The Personnel Information Subsystem provides data concerning certificated personnel and budget positions. The data are disseminated through two recurring reports, the *Master Personnel Inventory* and the *Statistical Summary of Certificated Personnel*. The *Certificated Personnel Questionnaire* and other District forms provide data input. The primary data file reposits detailed information concerning personnel qualifications and available budget positions within a particular area of responsibility.

PROGRAM/BUDGET INFORMATION SUBSYSTEM

The Program/Budget Information Subsystem provides several recurring reports, including the *Master Program Inventory*, the *Program/Fund Budget Crosswalk*, and the *Program/Expenditure Class Budget Crosswalk*. The Master Program Inventory lists all educational programs; the two crosswalk reports describe current and projected school budgets, and relate traditional accounting classifications to the program budgeting display. The primary input-data form is the *Program Budget Document*, included in the *Program Memorandum*.

EDUCATIONAL RESULTS INFORMATION SUBSYSTEM

The Educational Results Information Subsystem generates the following recurring reports:

- *Master Classroom Inventory*;
- *Longitudinal School Evaluation Report*;
- *Longitudinal Classroom Evaluation Report*;
- *Longitudinal Program Evaluation Report*.

In addition, the information system provides several exception reports, which indicate unusual classroom, school, or program activity. These include:

- *Classroom Exception Report*;
- *School Exception Report*;
- *Program Exception Report*;
- *Longitudinal Classroom Exception Report*;
- *Longitudinal School Exception Report*;
- *Longitudinal Program Exception Report*.

Data are stored on the *Evaluation History and Classroom Master File*, a flexible file capable of evolving into a student-level file.

COMMUNITY PROFILE INFORMATION SUBSYSTEM

The Community Profile Information Subsystem generates the *Demographic Data Report* and the *Community Interest Profile*. These reports provide the decisionmaker with socioeconomic data on the school service area. They also reflect community reactions to proposed educational programs and strategies. Data for these reports are gathered from District sources and from recurring community questionnaires.

INQUIRY SUBSYSTEM

The Inquiry Subsystem produces no specific reports; rather, it is a tool for accessing and analyzing all data stored in the other subsystems. The Inquiry Subsystem provides the decisionmaker with three general capabilities:

- *File inquiry*: Allows particular data items to be rapidly retrieved from relevant files;
- *Statistical analysis*: Provides a variety of packaged programs for statistical testing of system-stored data;
- *Cost modeling*: Provides a rapid and simple method for determining the resource implications of prospective and existing educational programs.

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I. INTRODUCTION

This report describes the functional design of an information system supporting educational accountability and program budgeting for the Los Angeles Unified School District (LAUSD). A functional design is a graphic and verbal system description, defining system inputs, necessary processing of these inputs, and resultant informational outputs. A functional design describes only the steps (or functions) performed; it makes no judgment concerning effective hardware or software alternatives. Ideally, it describes both a manual and an automated system equally well. Reference 1 specifies and analyzes the various hardware and software configurations that might be chosen to support the information system.

RESEARCH APPROACH

Output was chosen as the most attractive starting point for system design because it composes the end product of the information system, whose function is to serve customers. Ordinarily, users see only output and, naturally, base their judgment of system effectiveness on how well their needs are served. Output is thus most critical to the information system's success. Once a spectrum of outputs and services has been agreed upon by decisionmakers, specification of necessary data, file formats, and data collection and processing procedures may proceed, using the output specifications as the design anchor.

This report is organized by information system components. Section II discusses the types of reports and services necessary for effective educational management, detailing the rationale for each general type, and providing examples of how these are used. Sections III through VII describe the individual systems for each functional area.

INFORMATION SYSTEM SCOPE

In the system proposed here, the school principal is the keystone of accountability [2]. As such, he must make decisions related to

personnel, budgets, educational programs, and the like. Therefore, the information system is designed to directly serve his needs. All the reports described as output are intended for the principal's use. Although many reports will reach higher levels of educational management, such reports will simply aggregate the data displayed for the principal. In most cases, these reports are not specifically shown, although they are named and associated with the parent reports in the distribution chart in Ref. 1. In short, the information system is designed for the specific use of the school principal, the logical focus of accountability.

For both day-to-day and long-term decisionmaking, the principal needs information in four general categories:

- *Personnel:* Information concerning the capabilities, interests, and educational and employment histories of those accountable to him.
- *Program/Budget:* Information describing the nature, effectiveness, and near- and long-term costs of educational and support programs.
- *Educational Results:* Performance data on students participating in the various classes, educational programs, and testing programs within his school.
- *Community Characteristics and Interests:* Information describing the community from which students are drawn. Such information includes parental desires, the student's socioeconomic environment, and the public's image of the school.

A total information system would provide many services not included in the prototype. Although it is difficult to predict the final degree or configuration of decentralization for accountability, many services will continue to be performed centrally because of either economies of scale or simple precedent. Therefore, these services are not considered part of the information system. They include most of the business functions, such as:

- *Payroll:* All payroll processing is best performed in a central location. Payroll is already mechanized in the District's Data Processing Branch.

- *Inventory Control:* This service is also performed most economically at a single location because size tends to smooth variations in consumption. Again, a functioning system of the Data Processing Branch effectively handles inventory control.
- *Facilities and Maintenance:* Monitoring building condition and scheduling maintenance are also areas suited to central control. This problem is currently under joint examination by the District and its consultants. For these reasons, it is not considered for implementation with the prototype system.

II. INFORMATION SYSTEM ORGANIZATION AND USE

A successful information system must be specifically tailored to the needs of decisionmakers, providing data related to specific decisions. Moreover, the *amount* of information provided is critical: too little information provides inadequate support for decisions; too copious information may overwhelm the administrator with irrelevant data. The system described herein solves the first problem by producing only reports related to specific, articulated educational decision areas. The second is solved by providing various levels of information output, differing primarily in the depth, detail, and comprehensiveness of their associated data.

INFORMATION/DECISION RELATIONSHIPS

Figure 1 is a matrix relating the various products of the proposed information system to the educational decision areas discussed in Ref. 3. Decision areas are listed vertically along one side of the page, and specific reports (detailed in Secs. III through VII) are listed across the top of the page. Decision areas are related to reports by an "X" at the intersection. This matrix accounts for only the most obvious relationships; most of the areas listed are sufficiently complex to require a very broad information base.

SYSTEM OUTPUT STRUCTURE

Information is provided the decisionmaker in three forms: recurring reports, exception reports, and inquiry reports. *Recurring reports* provide decisionmakers with a broad information base. They exist primarily as master lists and inventories, supplying information on the major characteristics of personnel, programs, classrooms, and schools. The information system produces recurring reports at regular intervals for purposes of information and background.

Exception reports point up unusual behavior within the educational system. They serve as notification to the administrator that the information system has sensed achievement (or nonachievement), attendance

INFORMATION SYSTEM REPORT

EDUCATIONAL FUNCTION	PERSONNEL		PROGRAM / BUDGET				EDUCATIONAL RESULTS							COMMUNITY PROFILE		INQUIRY SERVICES		
	Master Personnel Inventory	Statistical Summary of Certificated Personnel	Master Program Inventory	Prog./Fund Crosswalk Report	Prog./Ex. Class Crosswalk Report	Program Expenditure Report	Master Classroom Inventory	Program Evaluation Report	Long. Classroom Eval. Report	Long. Program Eval. Report	Classroom Excpt. Report	Long Classroom Except. Report	Long. Program Excpt. Report	Demographic Data Report	Community Interest Profile	File Inquiry	Statistical Analysis	Cost Modelling
PLANNING & RESEARCH																		
Establish Goals and Objectives	X	X	X											X	X	X		
Design Alternative Programs	X		X											X	X	X	X	
Select Programs			X											X	X	X	X	X
Establish Performance Criteria							X	X	X	X				X	X	X		
Develop Budget			X	X	X											X		X
Identify Points of Accountability	X															X		
Establish Evaluation Strategy							X	X	X	X						X		
Allocate Resources	X		X	X	X											X		X
ADMINISTRATION																		
Monitor Overall Educational Outcomes							X	X	X	X	X	X	X			X		
Monitor Expenditures						X										X		
Allocate Discretionary Resources			X	X	X	X										X		
Report Progress to Public		X														X		
Report Average Daily Attendance																X		
INSTRUCTION																		
Establish Instructional Strategies	X																	
Evaluate Individual Educational Progress							X		X		X	X				X		

Fig. 1--System Products Related to Educational Functions

(or nonattendance), expenditures, or conduct patterns that fall outside the broad boundaries of "what is expected." These boundaries are established by the administrator and displayed with the exception reports. In many cases, recognition of exceptions is a crude procedure, and noted exceptions can be explained by normal variations. In others, however, system-reported exceptions act as an early indication that a particular educational strategy or tactic either is not working well or is producing outstanding results.

Exception reporting serves two purposes: (1) it gives initial indication of unusual occurrences to the administrator (which he might otherwise not perceive or perceive only by sifting and correlating massive amounts of data); and (2) the early warning allows educational programs to be changed before they are complete. Although such changes might be too hastily made on the basis of exception reports, these reports allow the administrator to monitor results and thus control educational progress.

Inquiry reports are answers to direct questions posed to the information system. A large portion of system time is expected to be devoted to answering these specific requests for information. Recurring and exception reports are designed to provide administrators with an absolute minimum of background and general information. The observation that administrators have neither the time nor the inclination to pour over mounds of questionably relevant data led to the conclusion that a capability must exist to provide decisionmakers with precise, relevant information on demand. If this is not done, information system acceptance may be difficult to obtain.

Provision is thus made for administrators to use the information system--for management--in a hierarchical manner:

- Level 1: An *exception report* notifies the administrator that some exceptional activity has been perceived. In some cases, he will either know the cause of the exception or not care to pursue it, in which case he need not use the system further. However, if he wishes to gain a fuller understanding, he may proceed to the information system's second level.

- Level 2: The administrator examines *recurring reports* to gain more information on the noted exception. Should an exceptional classroom performance be noted, the principal might wish to examine the classroom's past performance (in history reports), or to note the particular qualifications of the classroom instructor.
- Level 3: *Inquiry reports* provide the third level of information access. Here, the administrator poses a question to the information system to gain either additional information or different aggregations of the information that concerns him. Inquiry reports offer a rapid means of (1) judging the implications of a policy change, (2) relating performance to other educational variables, and (3) searching for particular combinations of (personnel) talents or (classroom) achievement.

This hierarchy provides the administrator with all the information in the system, in a form usable for decisionmaking but in a way that avoids inundating him with information he will seldom use. The three-level access gives a considerable (but not overwhelming) amount of information on a regular basis, but leaves the administrator the option of searching in depth for causes and effects.

EXAMPLES OF INFORMATION SYSTEM USE

The two imaginary examples below illustrate the nature of the hierarchical system. Each demonstrates the way an educational administrator, faced with a problem, might use the system to gain further insight or understanding.

A High-Achievement Classroom

Administrator X, a primary-school principal, receives a *Classroom Exception Report* (see p. 48). According to this report, Section 2 of the fourth grade achieved unusually high scores on the State Reading Test. To determine the reason, X first examines the *Longitudinal Classroom Evaluation Report* for the previous two years. Examination of these reports shows that the current achievement test scores are considerably higher than those reported for fourth-grade classes for the last two years. A further check shows that last year's third-grade scores were

considerably lower; thus, it is unlikely that the scores are attributable to a classroom of exceptional students.

The administrator knows that the instructor, Mrs. A, is a first-year transfer from school 102. A look at information concerning her on the *Master Personnel Inventory* reveals nothing unusual: Mrs. A has taught for a total of twelve years (ten in the District), possesses a bachelor's degree, and is interested primarily in teaching elementary school.

In further pursuit of an answer, X requests the following information from the inquiry system:

- Reading achievement test scores for all fourth-grade classes from school 102 for the previous year; and
- Reading achievement test scores for all third-grade classes from school 102 for the year before that.

The inquiry results show that school 102 exhibits a pattern similar to that of his own school. Mrs. A's fourth-grade class exhibited unusually high achievement, compared both to other sections at school 102 and to the third-grade scores at school 102 for the preceding year. X can draw no final conclusions from this information; test scores are often suspect indicators, and other factors may have influenced both outcomes. Nevertheless, there is a high probability that Mrs. A is the reason for the unusual pattern. It is likely that the administrator would follow his information system search with a conversation with Mrs. A, gaining further knowledge of her capabilities and teaching methods.

An Under-Achieving Program

Administrator Y receives a *Program Exception Report* (see p. 50), which notifies him that a vocational education program designed to teach data-processing skills is faring less well than expected. Y first examines the *Master Program Inventory* to gain background on the program. The budget figures indicate that the program is funded "sufficiently": money has been made available for instruction, audiovisual equipment, guest lecturers, and equipment rental. A similar check of the Master

Personnel Inventory shows that the instructor, Mr. B, has received training in data processing in the Army, and has also taken night courses in this area.

A discussion with Mr. B reveals that, despite his training, he is not fully conversant with the range of skills to be taught in the data-processing program. Mr. B suggests that hiring another instructor to teach keypunching and manual card operations would fill the gaps currently causing problems. Following this conversation, Y addresses the following question to the inquiry system:

- List all personnel holding certificates in both business instruction and mathematics who are interested or have special experience in data processing.

The answer lists eighteen individuals. Of these, three have special experience, and one has indicated a preference for teaching in Y's area. Y then designs a new data-processing program, identifying the resources necessary, including the new instructor. He then forwards the specification of resources for input to the inquiry system, requesting a five-year budget projection. The inquiry system calculates that the cost of the new program exceeds that of the old; by eliminating the guest lecturers, however, Y is able to bring program cost in line with his original budget.

III. PERSONNEL INFORMATION SUBSYSTEM

The Personnel Information Subsystem is one of five subsystems composing the complete information system. A primary need in the area of personnel information is for data on the status, capabilities, and preferences of certified, classified, and volunteer employees. This information is used extensively in planning activities. For example, the school principal contemplating establishment of a Spanish program needs to know how many of his staff are fluent in Spanish, their current assignments and teaching loads (to determine whether he will need to draw on other resources, or to judge the practical implications of a change in program mix), and approximate personnel costs (to make rough estimates of program cost). For morale purposes, and to insure appropriate job-man matching, personnel information should also provide data on the aspirations of teachers and administrators.

A second major use of the Personnel Information Subsystem is in budget-related activities. Information is reposited both on budget positions and on personnel filling these positions. This allows the budgeting authority to estimate costs of future programs. These budget data, although stored in the Personnel Information Subsystem, are displayed in reports described under the Program/Budget Information Subsystem (Sec. IV). Figure 2 shows the functional operation of the Personnel Information Subsystem, illustrating input media, processing steps necessary for file maintenance, and products (ancillary files and reports). Each item is fully described below.

PERSONNEL/POSITION SUBSYSTEM DATA FILES

Data in this area may be reposited logically in three conceptually or physically separate files. These data bases must describe the characteristics of current positions, their incumbents, and the employee's history. In order to do this efficiently, while allowing for expected variations in the amounts of data required to describe each position, a file design must utilize hierarchical structures and variable-length records.

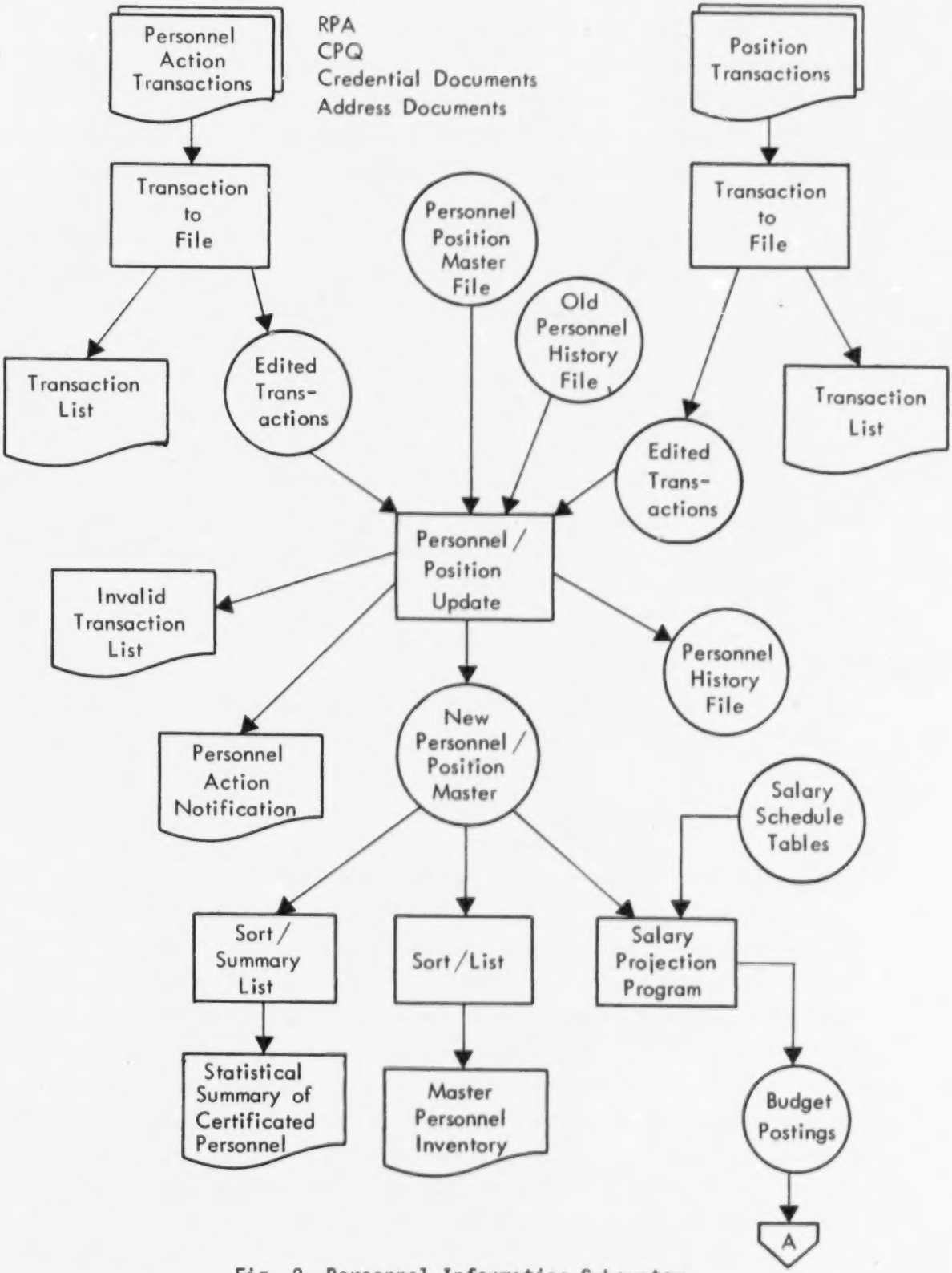


Fig. 2--Personnel Information Subsystem

The most straightforward approach uses a single file to carry data on both positions and incumbents, maintaining historical data concerning previous incumbents in a separate *Professional History File*. This approach stores as much information as possible into a single file to avoid the complexities associated with maintaining and using several files to develop a single report. The *Personnel/Position File* is ordered by position number, which also serves as the record key. The man number of the employee currently occupying the position is a second-level key. The Personnel/Position File may be used to associate the professional characteristics of an individual with the position he occupies, without referring to more than one file. The major virtue of this approach is its apparent simplicity; it should be an effective file design for both the prototype system and the highly decentralized District implementations (with consequent low-volume files). Disadvantages and difficulties that would be encountered if District implementation is a highly centralized configuration (six or fewer supporting configurations) are discussed below.

Interfile Dependence

One potential problem in a centralized environment stems from physically separate Personnel/Position and Professional History Files. (The latter exists because there is a requirement to maintain longitudinal records on present employees, as well as on those no longer employed by the LAUSD.) The requirement of having personnel data also in the *Position File* forces a higher level of redundancy in the personnel information maintained. Because of this interconnection of information items, personnel update transactions require both the Professional History and Personnel/Position Files to be updated simultaneously. On a technical level, simultaneous processing of more than one file places very stringent requirements on the ordering of records in the files. Avoiding this simultaneous processing would most likely require the transactions to be processed separately against each file, an inefficient process in a high data-volume environment. Initially, it appears that the ordering required for efficient simultaneous update across several files is inconsistent with the ordering required for efficient report generation.

In addition to file-coordination difficulties, the nature and frequency of transactions present another problem. Any update to a tape file necessitates rewriting the entire file; if the transaction is to update a personnel item, rewriting both files is necessary since information is kept in both files. Processing position transactions would probably frequently require rewriting both files.

Some of these problems can usually be solved, or at least reduced, by batching the transactions. The feasibility of this scheme depends greatly upon the frequency of transactions and the required degree of file currency. In addition, batching transactions to be processed efficiently in a multiple-file process can be very tricky, and may demand an inordinate level of file indexing expertise on the part of the user.

File Organization

Many of the problems discussed above apply to disk as well as tape files. At some point in the evolution of the system, the size of the files, as well as the processing requirements, can be expected to suggest the use of disk (or random-access) files. Although the general record design is suited to this kind of processing, simply switching to disk hardware cannot remove some of the more serious inefficiencies.

The largest gain in searching and updating efficiency could be accomplished, in a disk environment, by changing access methods. The index sequential method would be the most logical because it is relatively easy to use and because it is usually supported by commercial data-management systems. However, because the files are ordered on different keys, index-sequential organization might not prove very helpful. If the Position File was processed index sequential, nothing would be gained in the processing of personnel updates because the Personnel File would effectively be treated sequentially. Similarly, if the Personnel File was index sequential and the transactions were made against it, subsequent processing of the Position File would be equally inefficient.

The final design for Personnel/Position Files for a highly centralized system includes:

1. Maintenance of personnel and position data in two distinct master files, with the only redundancy in information being associated record keys. The *Position Master File* maintains information on budget positions, whereas the *Personnel Master File* maintains information concerning both active and inactive personnel.

2. Fields in each record in each file that contain the record key of the associated record(s) in the other file.

3. Index-sequential processing of files, with position number the record key in the Position File, and man number the record key in the Professional History File.

4. Updates to personnel information accomplished index sequentially by man number.

5. Updates to the Position File (e.g., funds and program numbers) done in index-sequential mode, with no need to search for the proper position.

6. Updates to information requiring cross updating in both files accomplished by index-sequential-coordinated file processing.

7. Sequential processing of reports concerning personnel. This is done because information is in one file. It also accommodates the inquiry system; reports on particular employees can be made without complicated file searches.

8. Reports of budget information, produced by using coordinated files, extracting the man number from the Position File, and finding the equivalent key (and record) in the Professional History File.

Figure 3 depicts the Personnel Master File; Fig. 4, the Position Master File. Figure 5 illustrates the format of the data file used to transfer salary information to the Program/Budget Subsystem.

LEVEL 1, SEGMENT 0, BASE SEGMENT

Man No.	Soc. Sec. No.	Name	Race	Start Date	Term. Date	Reason	Destination	Yrs. Svc. District

Current Salary	Premiums	Position No.	Org./ Loc.	Program	Classroom	Cert.

LEVEL 2, SEGMENT 1, REPEATING
RESIDENCE

Address	Telephone

LEVEL 2, SEGMENT 2, REPEATING
PREVIOUS ASSIGNMENTS

Position No.	Org./ Loc.	Program	Classroom	Cert.	Assign. Date	Term. Date

LEVEL 2, SEGMENT 3, REPEATING
EDUCATION

Major	Degree Level	Date	

LEVEL 2, SEGMENT 4, REPEATING
PERSONAL CHARACTERISTICS

Fig. 3--Personnel Master File

LEVEL 2, SEGMENT 5, REPEATING
OUTSIDE SERVICE

Loc. Code	Yrs.	Cert.	Class

LEVEL 2, SEGMENT 6, REPEATING
IN-SERVICE ATTENDANCE

Course Code	Date	

LEVEL 2, SEGMENT 7, REPEATING
CURRENT EDUCATION

Major	Degree Level	Anticipated Date

LEVEL 2, SEGMENT 8, REPEATING
LANGUAGE FLUENCY

Lang. Code	Fluency Code	Date

LEVEL 2, SEGMENT 9, REPEATING
CERTIFICATION HISTORY

Cert. No.	Yrs.	Starting Date

LEVEL 2, SEGMENT 10, REPEATING
SPECIAL QUALIFIERS

LEVEL 2, SEGMENT 11, REPEATING
PROFESSIONAL PREFERENCES

Org./ Loc.	Cert.	Subject Area	Grade Level	Class-room

Fig. 3--Continued

LEVEL 1, SEGMENT 0, BASE SEGMENT

Position Number	Org./ Location	Position Type	Salary Schedule	Count Seg. 1	Count Seg. 4	Count Seg. 5	Count Seg. 6

LEVEL 2, SEGMENT 1, REPEATING
FUNDING STRUCTURE

Program Code	Count Seg. 2	Percent of Position

LEVEL 3, SEGMENT 2, REPEATING
FUND CODE

Fund Code	Count Seg. 3	Percent of Position

LEVEL 4, SEGMENT 3, REPEATING
EXPENDITURE CLASSES

Expenditure Class	Percent of Position

LEVEL 2, SEGMENT 4, NONREPEATING
DESIRED CHARACTERISTICS OF INCUMBENT

Certifi-cate	Age Range	Race	Yrs. Exper.	Major	Degree Level	Language

LEVEL 2, SEGMENT 5, REPEATING
PREVIOUS INCUMBENTS

Man Number	Yrs. Held	Date Moved

Fig. 4--Position Master File

LEVEL 1, SEGMENT 1, BASE SEGMENT, NONREPEATING

Program Code	Date	Expenditures of Period	Count Seg. 2

LEVEL 2, SEGMENT 2, REPEATING
EXPENDITURES TALLIED BY FUND

Fund Code	Expenditures of Period	Count Seg. 3

LEVEL 3, SEGMENT 3, REPEATING
EXPENDITURES TALLIED BY EXPENDITURE CLASS

Expenditure Code	Expenditures of Period

Fig. 5--Personnel Budget Posting File

RECURRING PERSONNEL REPORTS

The general vehicle for conveying personnel information to the school principal and his superiors is the *Master Personnel Inventory*, shown in Fig. 6. This list is prepared semiannually for administrative use.

The Master Personnel Inventory is one of two recurring personnel reports slated for inclusion in the three-school prototype system. Other personnel reports are needed for use by District-level personnel, and additional reports will become necessary as the system expands its coverage to more than three schools.

The *Statistical Summary of Certificated Employees* provides a profile of school, area, or District personnel, reflecting aggregate age, experience, qualifications, and interests. Figure 7 shows the recurring form of this report. It is intended primarily as a device to provide quick answers, and as a key to the full inquiry capability to be provided within the prototype information system. This report, although recurring, is produced by the inquiry system. The principal specifies the format and data items to be summarized, and the report is then provided on a regular basis.

Personnel Data Input

Transactions to the personnel data file will be handled as they are now: through transmission of a *Request for Personnel Action* (also known as the RPA, or "greenie") to the information system. Other input forms are address cards and credential cards.†

A major additional input is the *Certificated Personnel Questionnaire* (CPQ), shown in Fig. 8. The CPQ provides an efficient means of gathering information on special personnel interests and capabilities. It is filled out by each certificated individual upon:

---

†Questions that may exist in the mind of the reader concerning the nature of the interaction between the prototype system and the machinery currently in operation in the District for processing personnel requests, etc., are addressed in Ref. 1.

AREA 1 MASTER PERSONNEL INVENTORY REPORT DATE: 11/15/74
NINETY-SIXTH STREET SCHOOL

NAME/ ADDRESS	TEL NO. ETHNICITY	YRS.SVC. LA	OTHER	RATE/ FUND	DEPARTMENT PROGRAM CODES	**QUALIFICATION DATA** DEGREE	MAJOR	LANG.	OTHER	**PREFERENCE DATA** POSIT.	CERTIF.	LOCAT.	/CERTIFICATES HELD(LINE 2)
ABRAMS, ALICE E.	294-2123	12	4	1024	ELEM.	PHD	MATHFR/SP			TEACH.	E2620	2	
3821 GRAYBURN AVE, LA	BLACK			100	01010306 01010308				E2620-ELEM.INSTR. S2540-MATH. A1450-ADMIN.				
ADAMS, RICHARD C.													
.....													

Fig. 6--Master Personnel Inventory

$

PAGE 37

STATISTICAL SUMMARY OF
CERTIFICATED EMPLOYEES

REPORT DATE:
11/27/74

ZONE A SUMMARY

EDUCATION, SALARY, AND EXPERIENCE:

YEARS SERVICE	BA/BS	MA/MS	PHD.	TOTAL	PERCENT
0-1	397	16	3	416	8.6
2-5	.	.			
6-10	.	.			
11-15	.	.			
16-20	.				
21-25					
26-UP					
TOTAL	1,117				
PERCENT	46.33				
AVG. SALARY	8,966				

LOCATION PREFERENCE OF ZONE A PERSONNEL:

ZONE PREFERENCE	1ST CHOICE (NO.)	1ST CHOICE (%)	2ND CHOICE (NO.)	2ND CHOICE (%)
A	***	**.*	***	**.*
B	.	.		
C	.	.		
D				

CERTIFICATION DATA:

NO. OF CERTIF:	0	1	2	3	4	5	TOTAL
NO.	***	**,***	*,***	***	***	**	**,***
%	*.*	**.*	**.*	*.*	*.*	*.*	***.*

OPERATING UNDER PREFERRED CERTIFICATE: **,***
PERCENT: **.*

Fig. 7--Statistical Summary of Certificated Employees

CERTIFICATED PERSONNEL QUESTIONNAIRE

FOR USE BY DATA PROCESSING ONLY

LAST NAME	FIRST	MI

HOME ADDRESS

CITY	ZIP	SCHOOL

PROFESSIONAL QUALIFICATIONS

Degree	Major	Minor	Attended From	Attended To	Rec'd Degree?

Certificates Held	Year Granted

PREFERENCES

	1st	2nd	3rd	4th
School (First)				
School (Second)				
Certificate (First)				
Certificate (Second)				
Certificate (Third)				

LANGUAGE FLUENCY

Language	Read	Speak	Write

OTHER QUALIFICATIONS

In the spaces below, list other qualifications not covered by the above (examples: Dramatics, Track and Field, etc.)

Fig. 8--Certificated Personnel Questionnaire

- o Inception of information system operation;
- o Change in responsibility, organization, or location;
- o Change in the individual's capabilities or interests.

The first two actions are system-initiated; the system dispatches a notification upon reception of an RPA. The third must be initiated by the certificated individual.

IV. PROGRAM/BUDGET INFORMATION SUBSYSTEM

The Program/Budget Information Subsystem collects, stores, and retrieves data concerning the financial status of the District. It aggregates stored information to display budgets and expenditures of the District, of a particular area or school, or of a program or program element. Figure 9 shows the data flow of this subsystem.

PROGRAM/BUDGET MASTER FILE

Figure 10 displays file organization and format of the *Program/Budget Master File*. As is the case with all master files within the information system, this file utilizes a hierarchical structure and variable-length records. The structure shown in Fig. 10 is equally adaptable to either serial (tape) or random (disk) access methods, although the diagram shown is specifically intended as an illustration of random-access file format.

RECURRING REPORTS

Five recurring reports are produced by the Program/Budget Information Subsystem. The first is the *Master Program Inventory*, a list of all programs currently underway or planned within the school, showing information on the program's nature, location, and funding sources. An example of the Master Program Inventory is shown in Fig. 11.

The information system produces two major budget reports, similar in design and use. These are the *Program/Fund Budget Crosswalk* and the *Program/Expenditure Class Budget Crosswalk*, both shown in Fig. 12. The crosswalk reports are the basic budget documents to be used within the District, area, or school; they are produced on a recurring basis as well as at the request of administrators. They are working documents, and can be produced both as a record of interim and final budgets and as reports on the expected financial implications of various program mixes that the administrator wishes to explore.

The crosswalk form of presentation allows the new program-oriented structure to be related to budgets previously oriented toward fund and

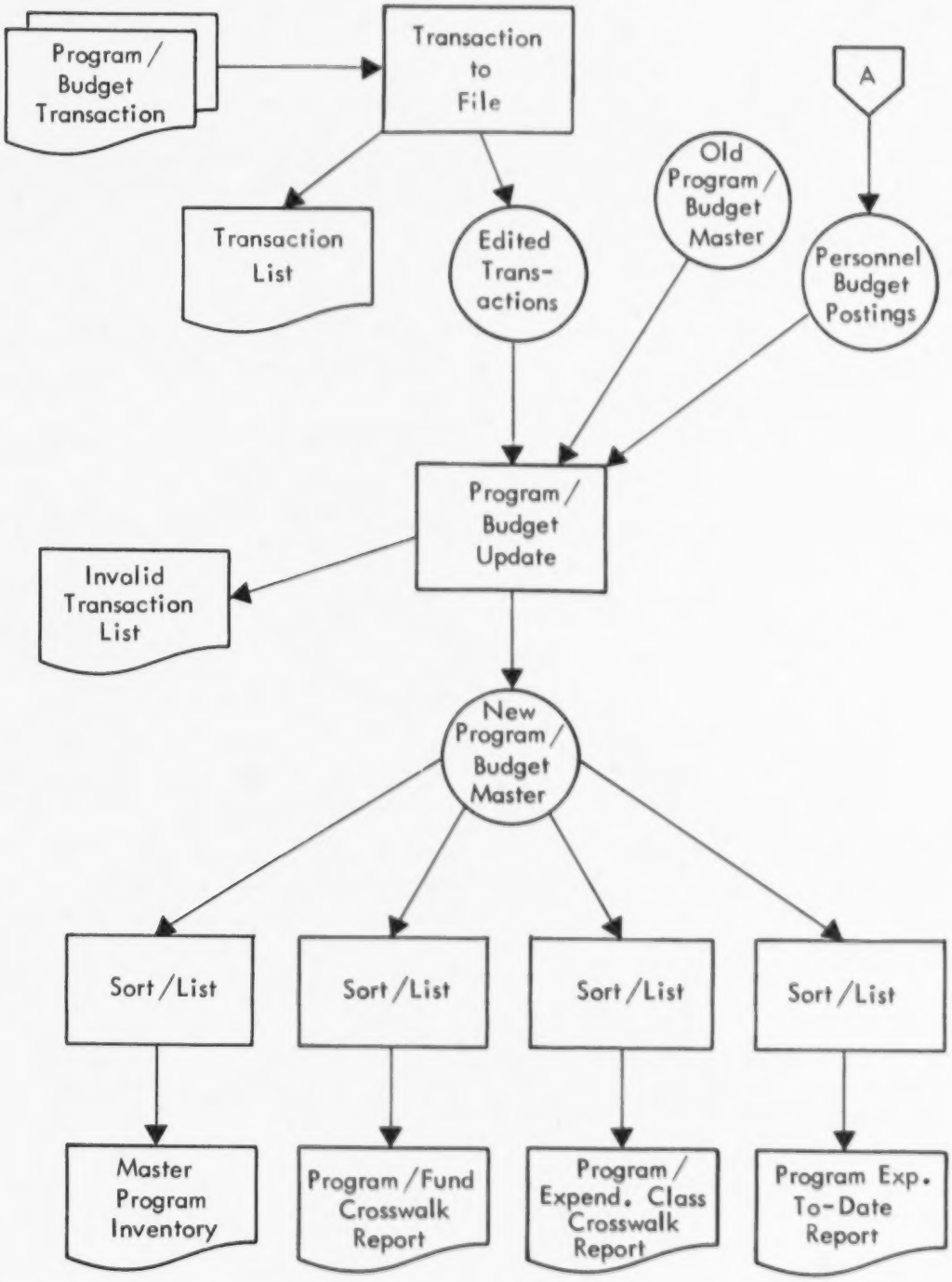


Fig. 9--Program/Budget Information Subsystem

LEVEL 1, SEGMENT 1, NONREPEATING
PROGRAM ACCOUNTING

Prog. Code	Status	Budget	Expenditures	Encumbrances	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Count Seg. 2

LEVEL 2, SEGMENT 2, REPEATING
FUND ACCOUNTING

Fund Code	Budget	Expenditures	Encumbrances	Count Seg. 3

LEVEL 3, SEGMENT 3, REPEATING
EXPENDITURE CLASS ACCOUNTING

Exp. Class	Budget	Expenditures	Encumbrances	Count Seg. 4

LEVEL 4, SEGMENT 4, REPEATING
EXPENDITURE CLASS ACCOUNTING
BY ACCOUNTING PERIOD

Expenditure	Encumbrances

Fig. 10--Program/Budget Master File

AREA 1
NINETY-SIXTH STREET SCHOOL

MASTER PROGRAM INVENTORY

REPORT DATE 11/15/74

PROGRAM CODE	PROGRAM DESCRIPTION	PROGRAM BUDGET FY1974	FY1975	FY1976	FY1977	FY1978	REVENUE SOURCE FUND/AMOUNT		FUND/AMOUNT		FUND/AMOUNT		TOTAL STUDENTS
01010201	ELEM. READING	15220	15850	16280	17000	18250	10	12300	20	700	80	2220	522
01010202	ELEM. ENGLISH	18440	22620	25460	27540	30000	10	16400	30	1840	90	200	597
010102	TOTAL GEN. ELEM. ED.	33660	38470	41740	44540	48250							
0101	TOTAL GENERAL ED.	33660	38470	41740	44540	48250							

Fig. 11--Master Program Inventory

AREA 1
NINETY-SIXTH STREET SCHOOL

PROGRAM/FUND BUDGET CROSSWALK

REPORT DATE: 11/15/74

PROGRAM CODE	PROGRAM DESCRIPTION	FUND 10	19	20	30	40	50	60	70	80	90	XX	XX	TOTAL COST
01010201	ELEM. READING	12300		700						2220				15220
01010202	ELEM. ENGLISH	16400			1840						200			18440
010102	GEN. ELEM. ED.	28700	1200	700	1840						200			33660

AREA 1
NINETY-SIXTH STREET SCHOOL

PROGRAM/EXPENDITURE CLASS BUDGET CROSSWALK

REPORT DATE: 11/15/74

PROGRAM CODE	PROGRAM DESCRIPTION	EXPENDITURE CLASS CODE 100	200	400	500	600	700	800	1100	1200				TOTAL COST
01010201	ELEM. READING	300	12590						2240	90				15220
01010202	ELEM. ENGLISH	450	16550	300	440				700					18440
010102	GEN. ELEM. ED.	750	29140	300	440				2940	90				33660

Fig. 12--Program/Budget Crosswalk Reports

expenditure class. The two reports shown are provided at the school level. Higher aggregations, reflecting the school budget as a single line item, will be provided to District decisionmakers.

The remaining report, the *Program Expenditures To-Date Report*, deals with program expenditures. Organized along the same lines as the budget reports, it details expenditures and encumbrances through a particular period of the school year. This report is displayed in Fig. 13.

AREA 1 PROGRAM EXPENDITURES TO-DATE REPORT DATE: 11/30/74
NINETY-SIXTH STREET SCHOOL

PROGRAM CODE	PROGRAM DESCRIPTION	BUDGET	EXPENDITURE TO-DATE	EXPENDITURE CURRENT-MO.	ENCUMBERED	BALANCE REMAINING
01010201	ELEM. READING	15220	3240	1820	5750	6230
01010202	ELEM. ENGLISH	18440	4480	2630	8200	5760
010102	GEN. ELEM. ED.	33660	7720	4450	13950	11990
0101	GEN. ED	33660	7720	4450	13950	11990

Fig. 13--Program Expenditures To-Date Report

PROGRAM/BUDGET DATA INPUT

The Program/Budget Information Subsystem requires two distinct sets of input. Budget data are provided at the school level by school decisionmakers. This information then flows to the area and District for aggregation into their respective budgets. Budget data are initially contained in the *Program Memorandum* prepared for each school program, and condensed on the *Program Budget Document*, shown in Fig. 14. This form contains basic program information, including the sources of each expenditure. When completed, it is prepared for machine input to the information system through whatever medium (optical character reader, keypunch, etc.) is chosen to support the actual information system configuration.

In exploring alternative program plans, the decisionmaker may use the budgeting system computationally, preparing input to a model that

PROGRAM BUDGET DOCUMENT

School:

Program or Element Title:

Program Level:

Program ID:

Expected Start/Finish Dates:

Program Objectives:

1.

2.

3.

4.

5.

Evaluation Instruments and Schedule:

Criteria/Test	Date
1.	
2.	
3.	
4.	
5.	

Program Budget (First Year)	Revenue Source (Fund)										
Total	10	19	20	30	40	50	60	70	80	90	xx

Fig. 14--Program Budget Document

calculates and displays the implications of various program strategies. The model is described in Sec. VII.

Expenditures and encumbrances will continue to be recorded and aggregated (through the prototype period) at the District level. Effective procedures have been developed, and there are no compelling reasons for gathering expenditure data at the school. Such gathering would save little time or money. Therefore, expenditures are gathered as usual, then disseminated by the District to the appropriate school.

V. EDUCATIONAL RESULTS INFORMATION SUBSYSTEM

The Educational Results Information Subsystem, portrayed in Fig. 15, manipulates information concerned with the achievement of students in particular classrooms or educational programs.

FILE COMPOSITION AND ORGANIZATION

This subsection discusses the contents of the *Evaluation History and Classroom Master (EHCM) File*, which provides an information structure for initial evaluation of some facets of program effectiveness.

Student behavior (e.g., grades, test scores, attendance, attitudes) under specified conditions (e.g., a given teacher, a given subject) is the basis of such program or classroom evaluation. Ideally, the EHCM File should reposit information on individual students. This is ruled out at present by the large student population (approximately 650,000) in the LAUSD, and the resultant hardware, software, and administrative support costs. A feasible compromise involves considering the smallest set of students who are in a similar environment. Classroom information must be examined with the understanding that the classroom concept is a compromise. Such phenomena as classroom turnover (in both personnel and instructors), use of flexible scheduling, and reorganizations, make much of the classroom data of limited long-term utility. Nevertheless, the classroom is the most stable aggregation of students that can be used as the basis of an information system.

This set--the classroom--is the lowest level of resolution in the EHCM File structure. Two types of aggregation of this basic unit must be possible through the file: by *organization/location* (such as schools, complexes, or areas), to judge results in these units; and by *program*, to allow management and evaluation of particular educational strategies. These two viewpoints are reflected in the EHCM record structure, summarized in Fig. 16.

School-Related Information

The key to the EHCM File is *school identification*, which (for each given school) contains information on:

- *Organization:* Elementary (kindergarten included), junior high school, senior high school.

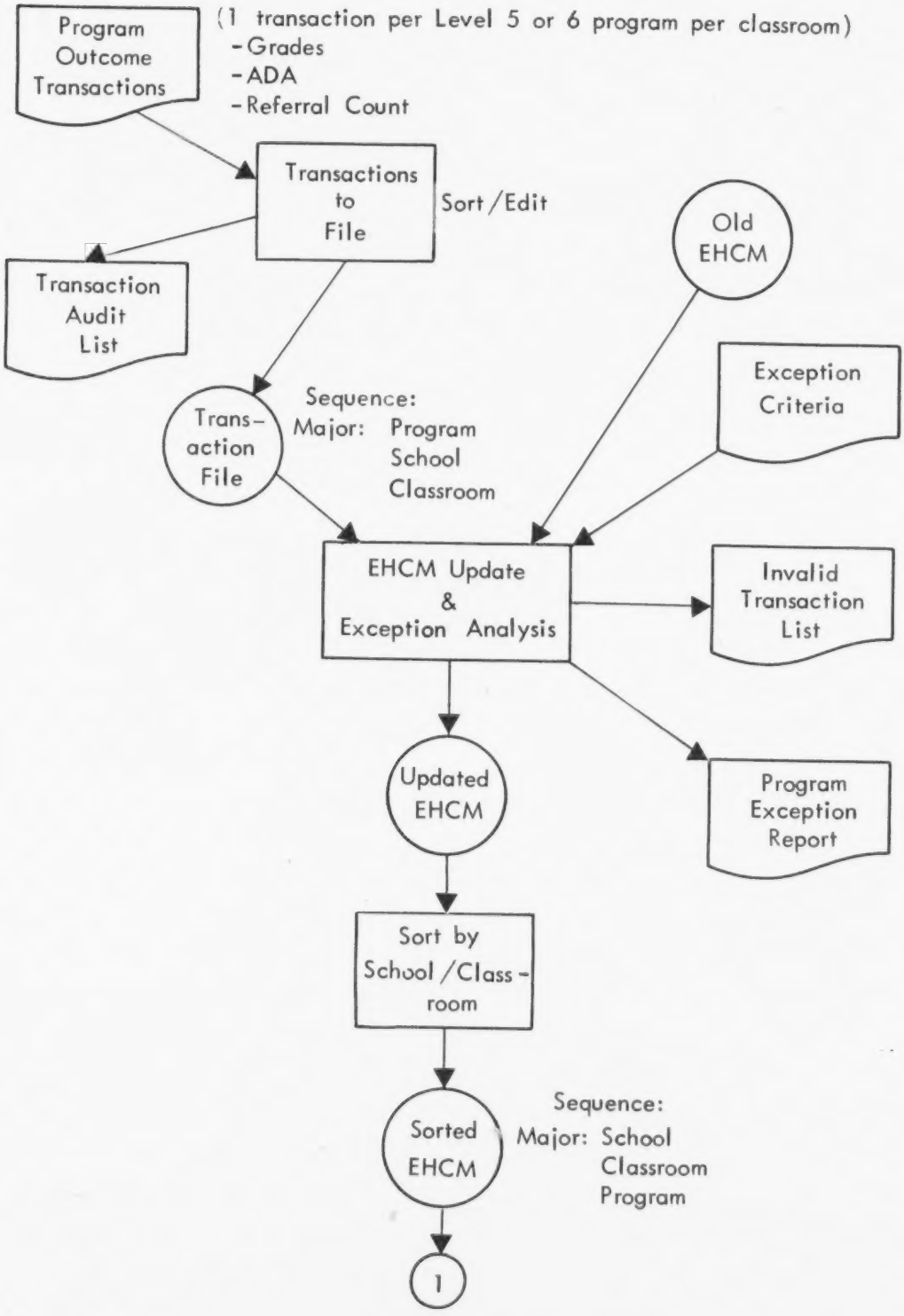


Fig. 15a--Educational Results Information Subsystem:
File Maintenance and Grade-Period Reporting

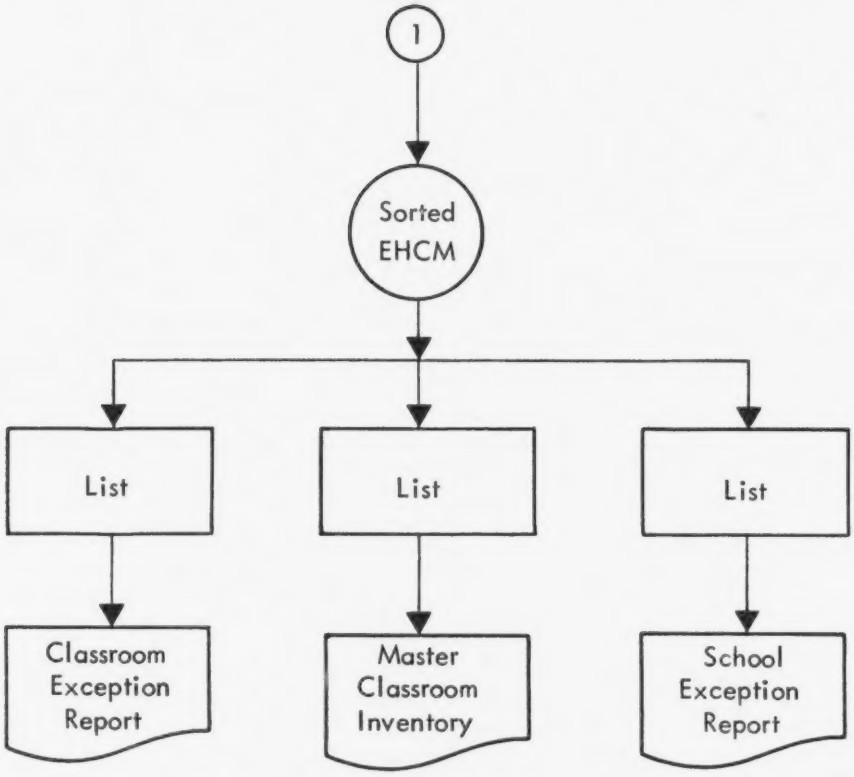


Fig. 15a--Continued

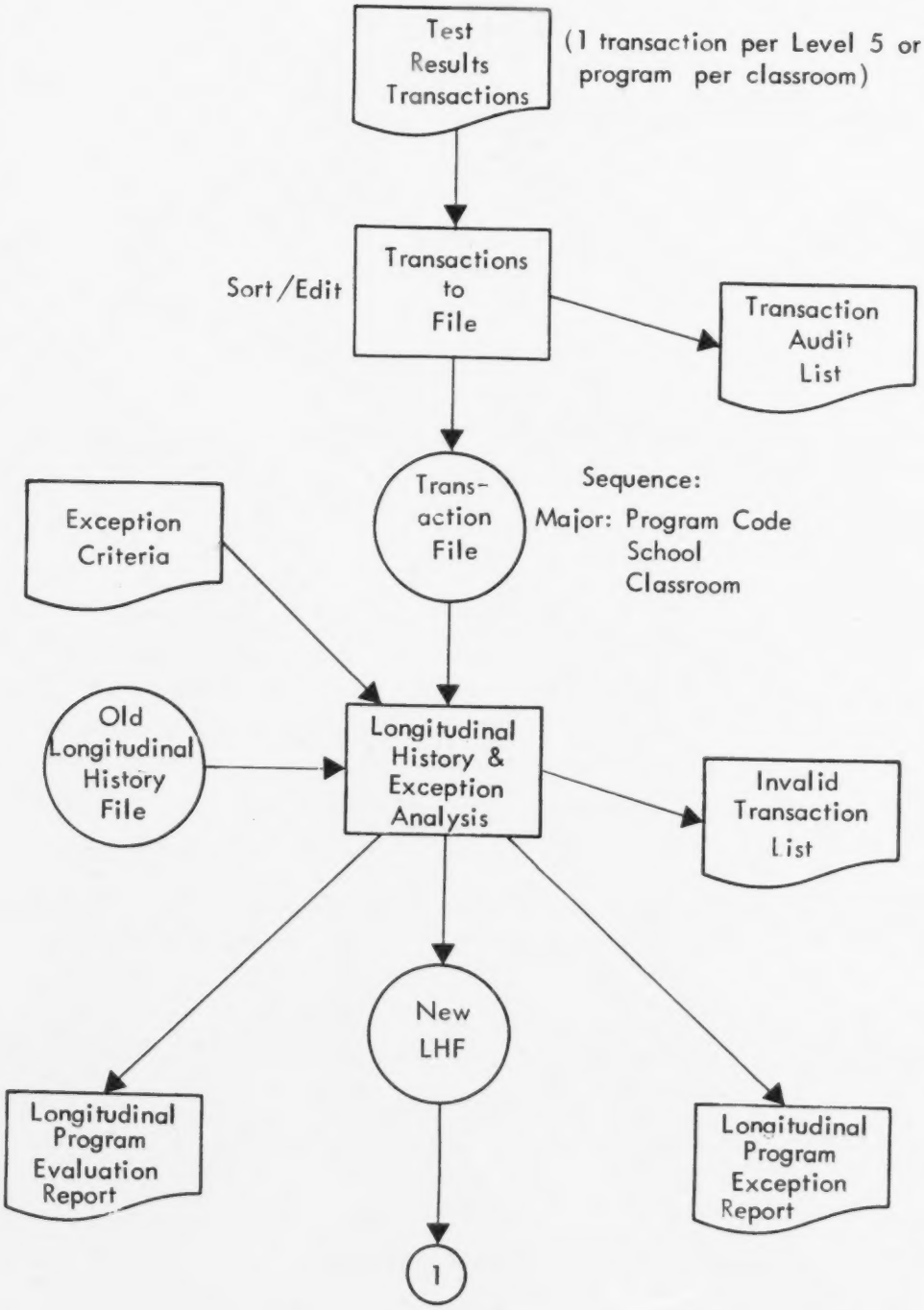


Fig. 15b--Educational Results Information Subsystem:
Test-Cycle Reporting

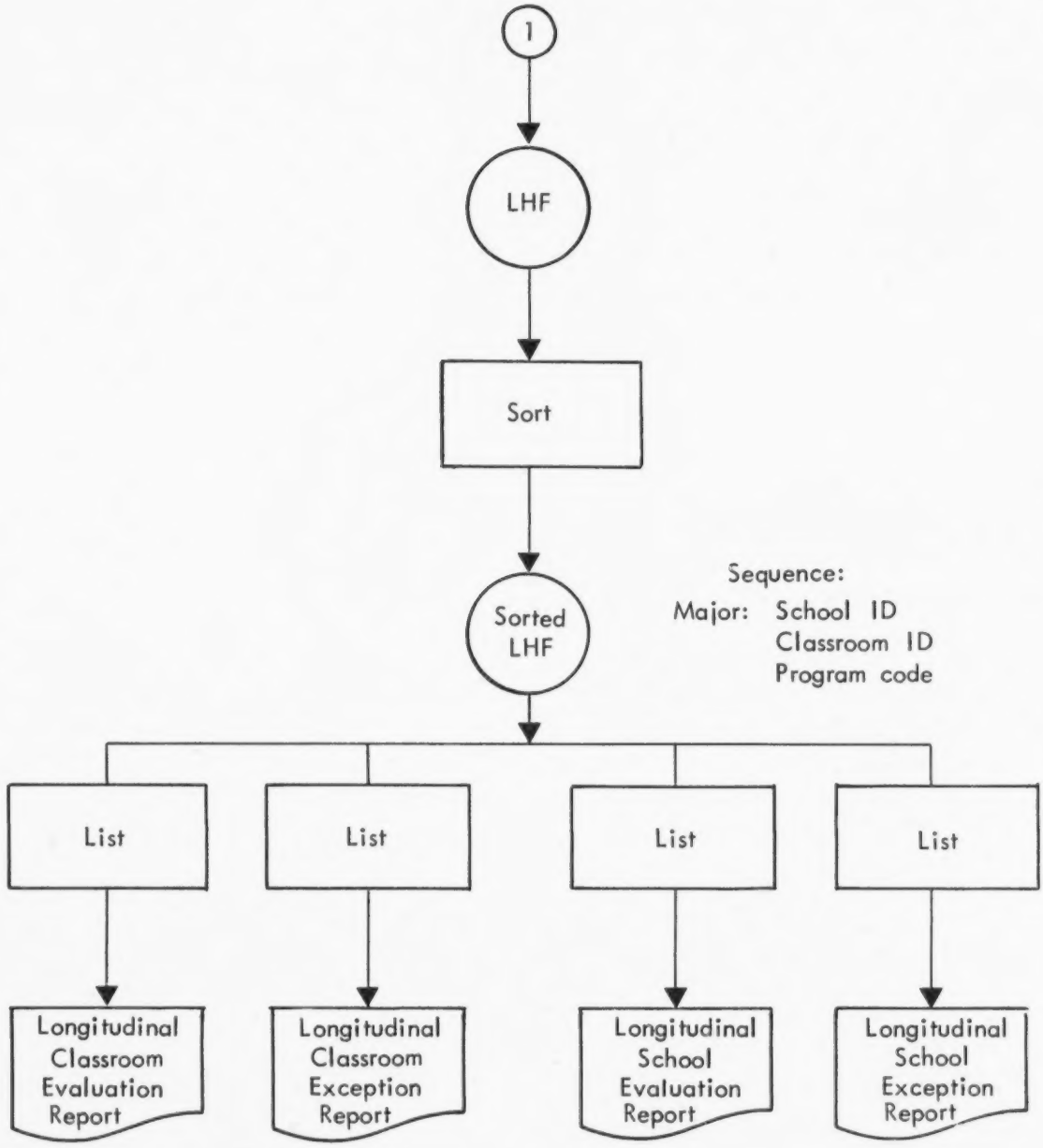


Fig. 15b--Continued

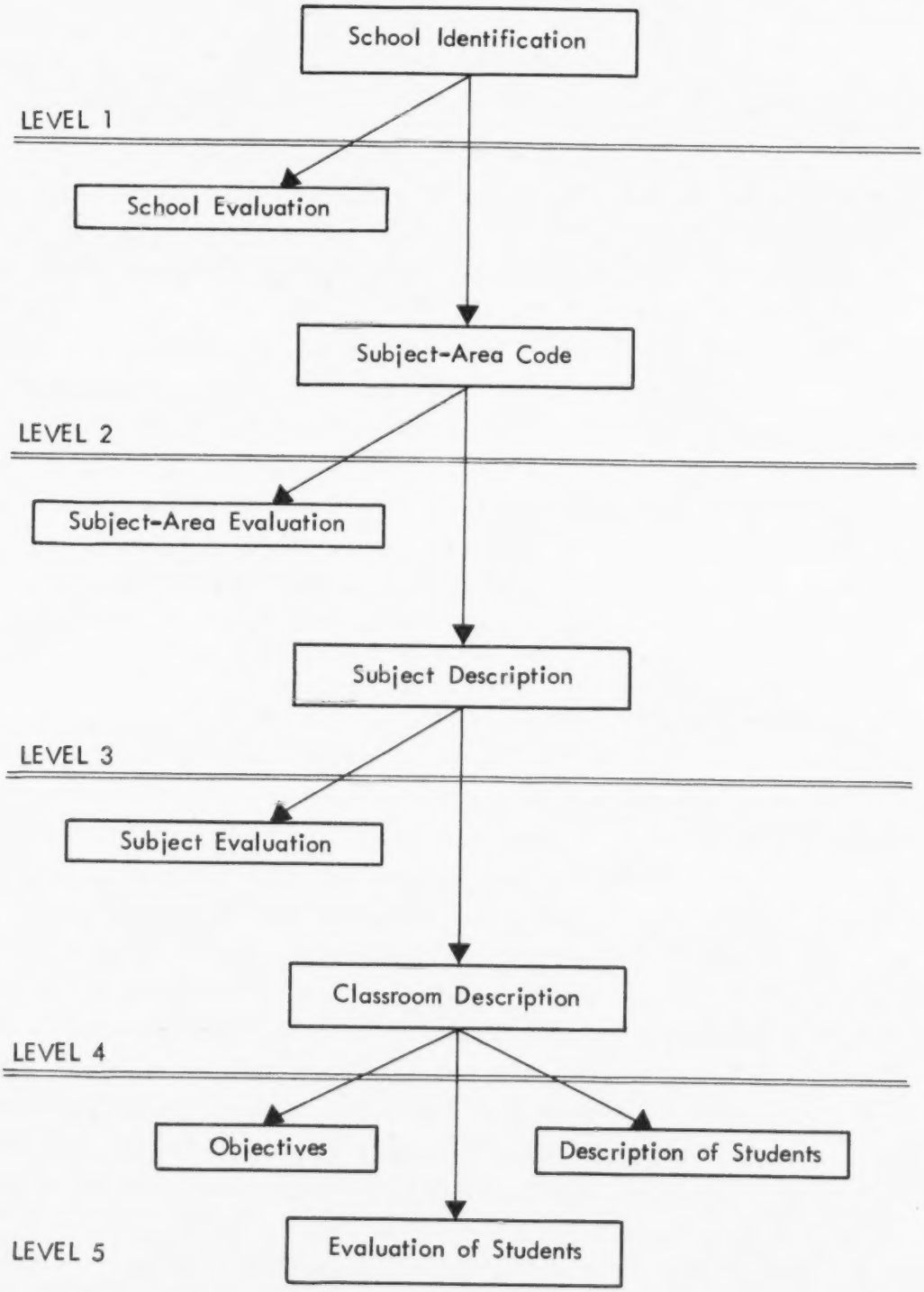


Fig. 16--Evaluation History and Classroom Master File Record Structure

(This corresponds to Level 4 of the State program structure.†)

- o *Location*: A unique identifier of the school's location.

A data item directly associated with organization/location is Average Daily Attendance (ADA). This item is a school-level aggregation of ADA reposited in the classroom-level detail records; it is included to assist the school principal in meeting District and State reporting requirements.

The EHCM File's primary concern is the evaluation of student performance. If the concept of student performance cannot be satisfactorily measured or defined, it will be equally difficult to arrive at a meaningful evaluation of an entire school, or of its different grades. (These difficulties are discussed in detail in Ref. 4.) Nevertheless, school descriptors in this area are provided (e.g., number of students from a high school entering a university or college). Again, the time periods covered by the different school evaluations should be made explicit.

Subject-Area Information

Level 2 of the EHCM File record structure categorizes the different subject areas within a school's educational program. Each Level-2 file category corresponds to a particular Level-5 category in the State program structure. No specific information is stored that aggregates Level-5 results; report summaries are done by the report programs.

The concept of subject area is perhaps less used in elementary schools than in senior high schools, which are loosely organized along departmental lines. However, elementary schools have become much more flexible, offering courses adapted to different sets of students. In addition, elementary schools test for particular subject-area achievement. Thus, subject-area identification is equally pertinent and necessary at the elementary level. The kind of *subject-area evaluation* will,

†This program structure is the one already designed for the LAUSD. Level 4 gives lifespan and site program grouping: preformal, elementary, secondary, post secondary, and adult. Preformal and adult school are not explicitly considered here. Their record structure would be similar to that of kindergarten (for preformal) and senior high (for adult schools).

of course, depend strongly on the *definition* of that particular subject area.

Special Programs Evaluation

A special program often consists of several components, which can be combined in different ways. For evaluation purposes, this set of components may be considered a *subject area* within the category special programs, and identified by a code similar to the Level-5 program code of the State program structure. The components will be described in the definition of that subject area. Evaluation data are identical to those reposited for other subject areas.

Special Education Identification

Level 5 of the program structure provides the different subject areas in special education: mentally gifted, mentally retarded, physically handicapped, etc.

Summer School Identification

Subject areas in summer school are similar to departments in general education. Lower levels of summer school file-record structure will be similar to those in general education. Special education in summer school is considered a separate category.

Classroom Data Items

The following information is stored for each classroom:

classroom code	man number of teacher(s)	duration(s) of class	facilities number	

institutional composition (aides, etc.)	actual class size	class ADA

average age/ (relative) number of students of that age	youngest age/ identification	oldest age/ identification	percent boys	

percent whites	percent blacks	percent Mexican American	percent oriental

percent Aid to Families with Dependent Children (AFDC)	information on student linkage between this and other classrooms

teacher objectives	instructional characteristics (if necessary)	classroom evaluation

When considering the different classrooms for a given subject, accounting is made of all individuals actually involved in that subject's teaching-learning process: teachers, students, aides, counselors, etc. Physical facilities† (e.g., classroom number) are also considered, as is the time period the classroom is in use.

Many of these data (actual class size, class ADA, etc.) change regularly; for each data item, the period of validity must be specified. When several teachers are involved in one classroom, other variables may be recorded, e.g., time spent by each teacher, facility used, and instructional strategy. This is particularly important for special and innovative programs.

†Here again, a linkage can be provided with the Physical Facilities Management System already in use by the LAUSD.

The elements required to describe the set of students depend on school location and level of education. The information stored on racial makup, although similar in structure to that provided by the Community Profile Information Subsystem, is produced by recognition (as opposed to school service-area survey).

Students in a regular classroom may be involved in special programs. Here again, file linkage is provided. The teacher's objectives are stated in summary form to maintain criteria for classroom evaluation. Instructional characteristics, if included, indicate instructional strategies used; these are necessary for a meaningful cost-benefit analysis.

The classroom-evaluation data field offers many opportunities to measure student performance. A likely set of variables is displayed with the EHCM File format. Depending on the kind of classroom decisions made, other variables may prove more useful. Instead of performing a single evaluation for the entire classroom, it may be desirable to separately evaluate groups within the classroom, e.g., by grade for some high-school classrooms. This requires identification of each group as a separate classroom, a purely administrative matter. The full format of the EHCM File is shown in Fig. 17.

RECURRING REPORTS

Four recurring reports compose this area of information system output. The first is the *Master Classroom Inventory* (shown in Fig. 18), which reports grades, test scores, and attendance by classroom, as well as pertinent data on the classroom's status, history, and character. "Classroom" may be defined at the elementary level as the particular grade/section. At the junior- and senior-high levels, classroom means course/section. Normally, each elementary teacher would have one "classroom," whereas each secondary instructor would have several.

The second recurring report is the *Longitudinal Classroom Evaluation Report*. It is published at the end of each evaluation cycle, and compares the performance of a particular classroom with that of current and past classrooms. This report summarizes achievement trends for a particular grade/section. It is often valuable because it charts the progress of an instructor remaining in one place over a period of time.

Level 1, Segment 0, Base Segment

Organization/ Location	Count Field 1	N_2 Field 2

Level 2, Segment 1,
Some Aggregate School-Level Information on Evaluation

Level 2, Segment 2, Nonrepeating
Subject Area or Department Program

Level 5 Program Code	Count Field 3	N_3 Field 4

Level 3, Segment 3,
Some Aggregate Subject-Area Level Information on Evaluation

Level 3, Segment 4, Nonrepeating
Subject

Code	Necessary/ Elective	Name	Prerequisites	Count Fields	N_4 Field 6

Level 4, Segment 5,
Some Aggregate Subject-Level Information on Evaluation

Level 4, Segment 6, Nonrepeating
Description of the Classroom

Man Number of Regular Teacher	Duration of the Class	Number of Classroom(s)	Maximum Class Size	
Actual Class Size	ADA	Count Field 7	Count Field 8	Count Field 9

Level 5, Segment 7,
Objectives of the Teacher/Class

Fig. 17--Evaluation History and Classroom Master File

Level 5, Segment 8,
Description of the Students

Average Age and Percent of Students	Youngest Age and Percent of Students	Oldest Age and Percent of Students	Percent Boys	Percent Whites	Percent Blacks
	Percent Mexican-American	Percent Oriental	Percent AFDC		

Level 5, Segment 9,
Evaluation of the Students

Examples of possibilities that can be combined in several ways, depending on the kind of program and the data available, are listed below:

1. Mark Point Average (Based on A, B, C, D, F, Incomplete, no Mark).

Number of Marks							Mark Percentages				Mark Point Average
#A's	#B's	#C's	#D's	#F's	#I's	#NM's	%A's	%B's	.....	%NM's	
x	x	x	x	x	x	x	x	x	..x..	x	x

(From a Middle High School of the Newport-Mesa Unified School District)

2. Average Grade Equivalents

	Boys	Girls
Pretest	x	x
Posttest	x	x
Gain	x	x

3. Overall Achievement Gain

	Pre	Post	Gain
Raw Score	x	x	x
Standard Score	x	x	x
Grade Equivalent	x	x	x

4. Achievement Gain

Septiles	Pre	Post	Gain
1	x	x	x---
2	x	x	x
:	:	:	:
:	:	:	:
7	x	x	x

Fig. 17--Continued

5. Norm Comparison

	Grade Score	Norm Percentile
75 Percentile	x	x
Median	x	x
25 Percentile	x	x

(From Report Number 302 LACS Auxiliary Services Division)

6. Evaluation on the Objectives of the Teacher/Class
For example:

Achievement	Attitude Toward School,	Adults,	Peers,	Environmental Awareness	Total
x	x	x	x	x	100

7. Attendance:
Referrals:
Suspensions:

Fig. 17--Continued

AREA 1
NINETY-SIXTH STREET SCHOOL

MASTER CLASSROOM INVENTORY

REPORT DATE:11/15/74

CLASS ID	CLASS DESCRIPTION	ENROLL-MENT	ADA	REFERRAL AVERAGE	INSTRUCTOR	GRADE AVERAGE CUM.	GRADE AVERAGE LAST	EDUCATIONAL PROGRAMS PROGRAM DESCRIPTION		
0401	GRADE 4,SEC 1	33	25.5	2.2	CUMMINGS	B	B	01020203 SPEC. ELEM. COMP.	01010201 GEN. ELEM. ENG.	01010203 GEN. ELEM. MATH
0402	GRADE 4,SEC 2	31	30.4	0.0	WATSON	B	B	01020203 SPEC.ELEM. COMP.	01010201 GEN. ELEM. ENG.	01010204 GEN. ELEM SCIENCE

Fig. 18--Master Classroom Inventory

The *Longitudinal School Evaluation Report* is a recurring report provided to the school principal and his superiors. It compares school performances, and is similar in form and rationale to the Longitudinal Classroom Evaluation Report. Both reports are illustrated in Fig. 19.

AREA 1 LONGITUDINAL CLASSROOM EVALUATION REPORT REPORT DATE: 06/15/75
NINETY-SIXTH STREET SCHOOL

CLASS ID	CLASS DESCRIPTION	YEAR	INSTRUCTOR	EDUCATIONAL OUTCOMES (%ILE) IQ	READ-PRE	READ-POST	MATH	SCI
0401	GRADE 4,SEC 1	1975	CUMMINGS	87.2	20.2	28.8	55.6	31.1
		1974	CUMMINGS	104.6	34.6	34.4	44.7	NG
		1973	WENNER	95.5	31.4	39.9	NG	44.6
04	GRADE 4	1975		93.2	30.6	35.5	41.1	22.2
		1974		100.1	38.4	38.1	49.9	NG
		1973		98.7	35.5	40.4	NG	38.8

AREA 1 LONGITUDINAL SCHOOL EVALUATION REPORT 06/15/71

NINETY-SIXTH STREET SCHOOL

GRADE	YEAR	EDUCATIONAL OUTCOMES (%ILE) IQ	READ-PRE	READ-POST	MATH	SCI	HIST	ENG
4	1975	93.2	30.6	35.5	41.1	22.2		
	1974	100.1	38.4	38.1	49.9	NG		
	1973	98.7	35.5	40.4	NG	38.8		
6	1975	100.2	37.7	41.6	55.4	39.9	52.5	66.4
	1974	103.4	39.9	39.7	39.6	26.6	50.1	NG
	1973	97.6	40.4	40.0	43.3	31.7	50.9	NG
SCHOOL	1975	100.1	36.6	39.9	40.4	31.1	44.6	60.6
	1974	98.8	35.4	38.8	42.6	35.5	50.1	NG
	1973	99.6	38.8	37.4	43.3	37.7	41.1	NG

Fig. 19--Longitudinal Evaluation Reports

The final recurring report is the *Longitudinal Program Evaluation Report*, shown in Fig. 20. This report compares the year-to-year results of a particular educational program. Its purpose and format follow that of the Classroom and School Reports described above. The Longitudinal Program Evaluation Report will be the primary instrument for evaluating educational programs within a particular school and, at some point in time, within the entire District. Therefore, it is imperative that consistent measures of progress be used and reported. If this is not done, program evaluation becomes difficult, if not impossible, removing many evaluative aspects from the program budgeting process.

AREA 1 LONGITUDINAL PROGRAM EVALUATION REPORT REPORT DATE: 06/15/75
NINETY-SIXTH STREET SCHOOL

PROGRAM CODE	PROGRAM DESCRIPTION	YEAR	NUMBER STUDENTS	PRE-TEST	POST TEST	GRADE AVG.	PROGRAM RESULT %ILE	PROGRAM RESULT PERCENT
01010201	GEN. ELEM. READ.	1975	855	34.7	39.6	B	4.9	14.1
		1974	821	33.6	40.1	B	6.5	19.3
		1973	833	34.5	32.2	C	-2.3	-6.7

Fig. 20--Longitudinal Program Evaluation Report

Present criteria used to compare one classroom or school with another (or with itself) are controversial. Information system designers are neither qualified nor competent to chose such criteria. As new measures of achievement are developed, the information system and its output must be altered to reflect them. And as criteria are enhanced, so will be the value and veracity of evaluation reports. These reports are therefore included, although at present they may seem of questionable value.

EXCEPTION REPORTS

Six exception reports are provided by the information system. The *Classroom Exception Report* (shown in Fig. 21) indicates unusual activity within a specific classroom. This report is produced when grades, ADA, or the quantity of behavioral referrals exceed or fall short of limits stored within the information system. Because the expected values for any of these quantities may vary widely from school to school, they are established separately for each classroom, and stored in the classroom's record.

The *School Exception Report*, also illustrated in Fig. 21, flags separate schools that exceed or fall short of specified criteria.

AREA 1 CLASSROOM EXCEPTION REPORT REPORT DATE: 11/15/75
NINETY-SIXTH STREET SCHOOL

CLASS ID	CLASS DESCRIPTION	EXCEPTION TYPE	CLASS RATING	CLASS NORM	INSTRUCTOR	EXCEPTION HISTORY
0401	GRADE 4,SEC 1	ATTENDANCE	22.6	29.9	CUMMINGS	10/15/75 ATTEN
0603	GRADE 6,SEC 3	GRADE	2.1	3.0	JOHNSON	10/15/75 GRADE

AREA 1 SCHOOL EXCEPTION REPORT REPORT DATE: 11/15/75
NINETY-SIXTH STREET SCHOOL

GRADE	EXCEPTION TYPE	RATING	NORM	EXCEPTION HISTORY
4	ATTENDANCE	24.4	29.6	10/15/75 ATTEN
5	READ. TEST	18.6	34.4	

Fig. 21--Exception Reports

Two longitudinal exception reports are provided by the information system: the *Longitudinal Classroom Exception Report* and the *Longitudinal School Exception Report*, both illustrated in Fig. 22. These exception reports are usually based upon some uniformly administered measurement

device, such as a standardized test. Again, separate criteria limits are established and stored for each classroom or school; variations in preparation and socioeconomic background make a single exception criterion meaningless.

AREA 1 LONGITUDINAL CLASSROOM EXCEPTION REPORT DATE: 06/15/75
NINETY-SIXTH STREET SCHOOL

CLASS ID	CLASS DESCRIPTION	INSTRUCTOR	EXCEPTION TYPE	YEAR	RATING
0401	GRADE 4,SEC 1	CUMMINGS	READING IMPROV	1975	8.8
		CUMMINGS	(POST-PRE)	1974	-.2
		WENNER		1973	8.5

AREA 1 LONGITUDINAL SCHOOL EXCEPTION REPORT DATE: 06/15/75
NINETY-SIXTH STREET SCHOOL

GRADE	EXCEPTION TYPE	YEAR	RATING
4	ADA	1975	23.2
		1974	29.9
		1973	28.4
6	HISTORY ACHEIV.	1975	57.6
		1974	32.4
		1973	30.3

Fig. 22--Longitudinal Exception Reports

Two exception reports are produced dealing with programs. The first of these, the *Program Exception Report* (Fig. 23), is produced whenever analysis of scheduled testing instruments indicates exceptions. The *Longitudinal Program Exception Report* (Fig. 24) displays year-to-year results of these testing programs. Should it be desired, however, longitudinal programs may be reformatted to display results at any interval, depending upon scheduling of the District testing program.

AREA 1 PROGRAM EXCEPTION REPORT REPORT DATE: 11/15/75
NINETY-SIXTH STREET SCHOOL

PROGRAM CODE	PROGRAM DESCRIPTION	EXCEPTION TYPE	RATING	NORM	EXCEPTION HISTORY
01010201	GEN. ELEM. READ.	INT. TEST	67.4	35.5	10/15/75 INT. TEST
01010205	GEN. ELEM. SCI.	INT. TEST	18.7	40.7	

Fig. 23--Program Exception Report

AREA 1 LONGITUDINAL PROGRAM EXCEPTION REPORT REPORT DATE:06/15/75

PROGRAM ID	PROGRAM DESCRIPTION	EXCEPTION TYPE	YEAR	RATING
01010201	GEN. ELEM. READ.	IMPROV(POST-PRE)	1975	4.9
			1974	11.6
			1973	10.1
01010205	GEN. ELEM. SCI.	ACHEIV.TEST %ILE	1975	67.4
			1974	34.3
			1973	32.1

Fig. 24--Longitudinal Program Exception Report

EDUCATIONAL RESULTS DATA INPUT

Three major categories of data must be supplied the Educational Results Information Subsystem:

- *Classroom characteristics*: Data concerning students in the classroom, educational methods used, and educational outcomes achieved.
- *Test results*: Data reflecting scores of school, area, or District testing programs.
- *Exception criteria*: The data, supplied by school, area, and District officials, which determine when a particular classroom or program is to be listed as an exception.

Classroom characteristics can be best recorded at the school level. Most of the information to be filed and reported is not currently

collected within the District. Therefore, establishment of a new collection mechanism will not represent a redundancy. In one case, attendance, data are now collected at the school level to produce the reports (J-18, etc.) necessary to establish the proper amount of State aid. In this case, the information system might simply be used to automate attendance accounting procedures.

One of the most attractive alternatives for collecting attendance and grade data involves use of the *Class Register*, kept by all instructors. This document records attendance and grades for each class or classroom, and may be summarized into a single line per classroom either by school clerks or by the teachers themselves. This data item, reflecting classroom performance, can be prepared for machine input in whatever form is chosen for information system implementation.

Test results involve a data-input problem similar to that described earlier for expenditure data. At present, all tests are forwarded to the Measurement and Evaluation Branch for scoring and analysis. Scored tests are subsequently returned to the school. Since the Measurement and Evaluation Branch prepares machine-readable input for analysis, the most rational approach for initial implementation might be for a duplicate set of such inputs to be produced and forwarded to the information system.

Finally, *exception criteria* must be provided by decisionmakers charged with monitoring educational performance. The school principal, working with instructors, would formulate separate criteria for each classroom. The Area Superintendent, working with the school principal, would likewise establish the exception range for each school. Any criteria may be used, specified either as a performance range (e.g., print as exceptions all classrooms having an ADA greater than 29 or less than 23), a function of previous performance (e.g., print as exceptions all ADA changes greater than 20 percent), or a function of the performance of other classrooms (e.g., print as exceptions all classrooms 20 percent below District ADA). Exception criteria may either be prepared on standard forms or input through a remote terminal located at the school. In any event, they must be constantly displayed to insure that they do not become "hidden decisionmakers."

VI. COMMUNITY PROFILE INFORMATION SUBSYSTEM

Two fairly recent educational developments establish a requirement for a method of assessing the nature and wishes of the community served by the school system: (1) the increasing recognition that a student's socioeconomic background strongly affects educational achievement; and (2) the growing belief that educational programs should vary with community interests and needs, and that educators must elicit and understand these needs. The Community Profile Information Subsystem provides both a means of repositing information on the community and a vehicle for routinely assessing and reporting community desires for public education. Figure 25 depicts the information flow within this subsystem.

FILE COMPOSITION AND ORGANIZATION

The items to be stored in the *Community Profile Master File* are shown in Fig. 26, along with that file's organization. It is expected that one physical record of the format shown will be maintained for each school service area. This requires some overlap of data within the file, since every District location will be served by an elementary, junior high, and senior high school. Maintaining a single record on each elementary school, and aggregating to obtain results for higher schools, is infeasible because a single elementary area may serve more than one junior high school.

RECURRING REPORTS

Demographic (or, more accurately, service-area profile) data are provided by the *Demographic Data Report*, illustrated in Fig. 27. Data are displayed on the financial base of each school service area, as well as on the ethnic origins of the students. Finally, an indication of the economic condition of the student's family is given through tabulation of AFDC assistance rendered. The Demographic Data Report is intended as an aid to administrators attempting to gauge short- and long-term enrollment, and the socioeconomic status of present and future populations.

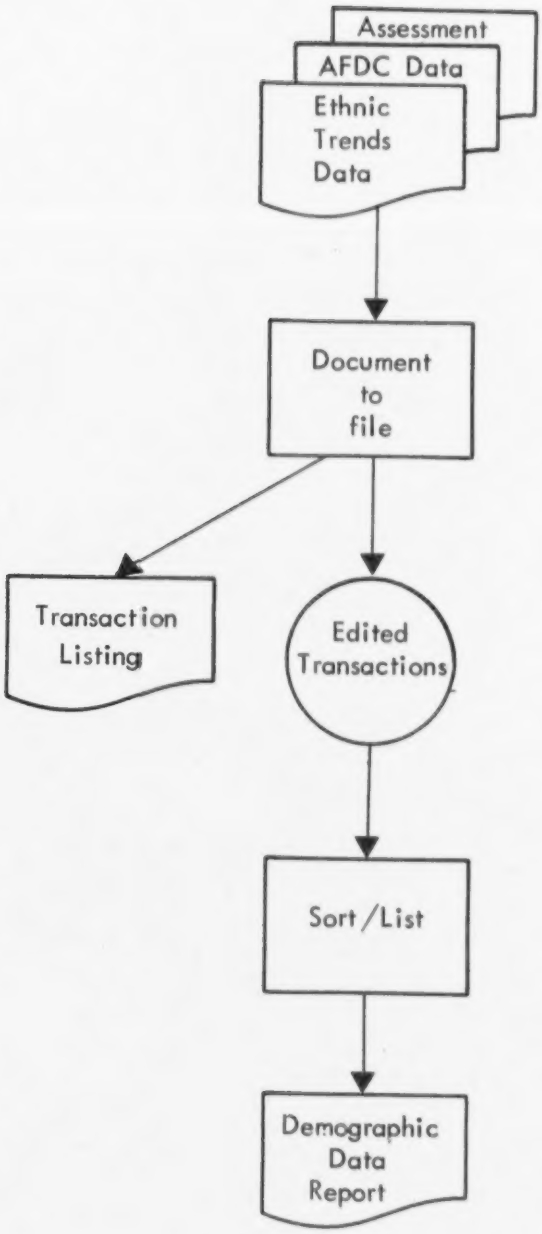


Fig. 25a--Community Profile Information Subsystem: Demographic Reporting

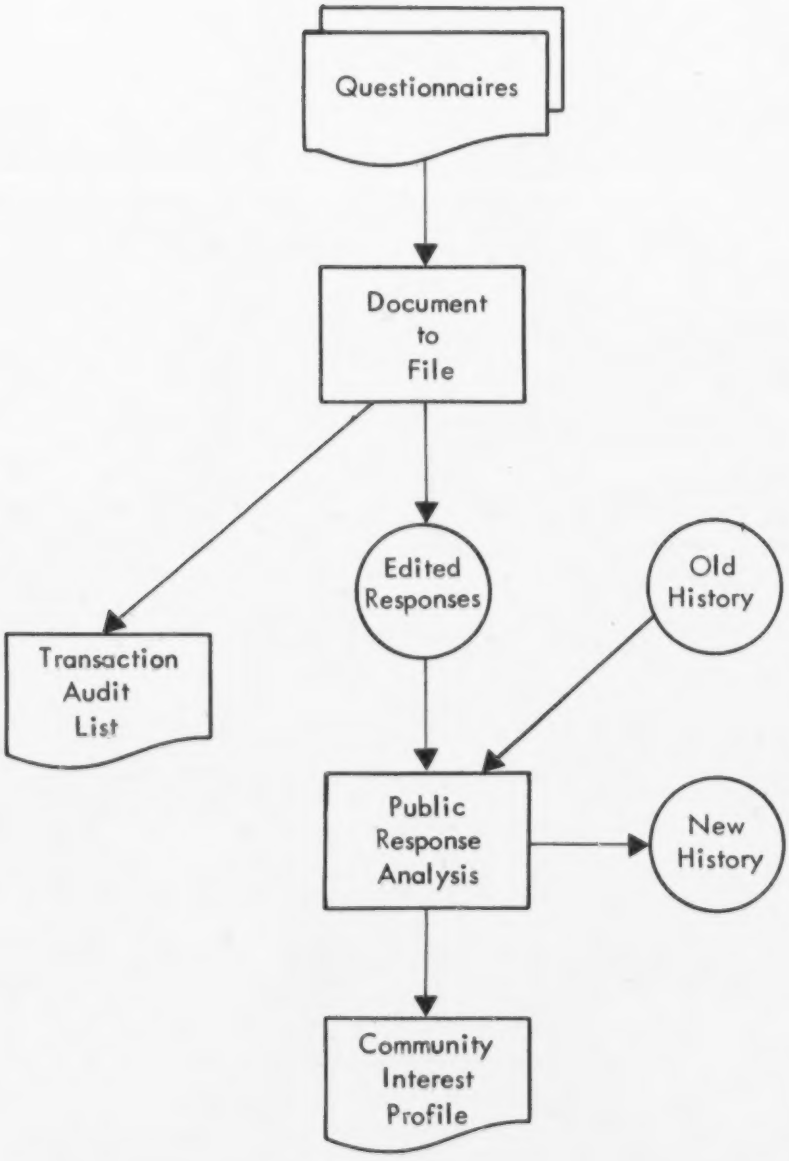


Fig. 25b--Community Profile Information Subsystem: Questionnaire Reporting

SEGMENT 0, BASE SEGMENT

Organization/ Location	Count Seg. 1	Count Seg. 3	Count Seg. 4	Count Seg. 5

SEGMENT 1, NONREPEATING
POPULATION SIZE, CONSTITUENCY (BY ETHNIC DESIGNATION)

Total Pop.	Student Pop.	Total White	Total Black	Total Sp. Surname	Total Amer. Indian	Total Oriental	Count Seg. 2

SEGMENT 2, REPEATING
PROJECTED POPULATION SIZE, ETHNIC CONSTITUENCY

Total Pop.	Student Pop.	Total White	Total Black	Total Sp. Surname	Total Amer. Indian	Total Oriental

SEGMENT 3, NONREPEATING
HEALTH, SOCIAL STATUS OF AREA

Mortality Rate	Morbidity Rate	% Medical	% AFDC	% Adult Ed. <6 Yr.	% Adult Ed. <12 Yr.	% Adult Ed. >12 Yr.

SEGMENT 4, NONREPEATING
ASSESSMENT OF FINANCIAL WORTH OF AREA

Total Area Assessment	Assessment Per Student	R1 Count	R1 Avg. Assessment	R2 Count	R2 Avg. Assessment

SEGMENT 5, REPEATING
CENSUS TRACTS INCLUDED

Census Tract No.	Percent Included

Fig. 26--Demographic Data Base

PAGE 602 DEMOGRAPHIC DATA REPORT REPORT DATE: 10/21/74

ZONE A

NINETY-SIXTH STR ELEM SCHL
18220 96TH STR

ASSESSMENT DATA:

SINGLE FAMILY DWELLING COUNT	10,562
MULTI-FAMILY DWELLING COUNT	1,416
AVG. ASSESSMENT, RESIDENTIAL	3,700
AVG. ASSESSMT, MULTI-RESIDENTIAL	6,500
TOTAL ASSESSMENT ATTENDANCE AREA	104,620,590
AVG. ASSED VALUE PER STUDENT	41,400

ETHNIC DATA:

	AMERICAN INDIAN			BLACK			ORIENTAL			SPANISH SURNAME			WHITE			TOTAL ENROLLMT.
	N	%	% CHNGE	N	%	% CHNGE	N	%	% CHNGE	N	%	% CHNGE	N	%	% CHNGE	%
1965	10	1.2		722	57.7											
1970	12	1.3	0.1	988	73.8	16.1										
1975	13	1.1	-0.2	1,422	89.6	15.8										

AFDC DATA:

FAMILIES UNDER:	$1000	$2000	$3000	TOTAL
NUMBER	122	241	326	709
PERCENT	16.7	22.9	44.4	85.0

Fig. 27--Demographic Data Report

As with evaluation reports, policy changes will alter the meaning and value of this report. District-wide racial integration will make data on the school service area irrelevant to the school principal. Such data will become valuable, however, to District officials, who may use the Demographic Data Report to judge the degree of integration achieved at each school. Information on financial base and AFDC assistance will have little practical value to integrated schools unless the demographic portion of the information system allows "tagging" specific students with specific backgrounds. This is not possible with a classroom-level system.

Community Needs and Interests

A strong need exists for information describing community desires, particularly as community guidance and control become increasingly widespread. The *Community Interest Profile* (Fig. 28) is intended as a free-form method of tabulating responses to regularly scheduled questionnaires submitted to the community. This device, although not perfect (in the past, response has been both sluggish and selective), seems an inexpensive method of gaining some qualitative understanding of a wide variety of school-related issues. A program that reads, stores, and prints out data on public responses must be free-form in character, capable of changing its format to reflect the particular questionnaire under examination.

The example shown in Fig. 28 tabulates the number of responses in various categories to two questions posed by the questionnaire. The lower portion of the figure displays a brief example of an "item analysis," correlating responses to question 1 with those to question 2. The leftmost column details the percentage of responses to question 2 of those answering "1" to question 1, and so forth.

INPUT MECHANISMS

Community interests and needs are assessed through a questionnaire, which may either be mailed directly to the parents or hand-carried by the students. Upon its return, the form may be "graded" in one of several

ways: optical character reader, keypunch, or manual tabulation. Data-reduction methods must be decided on the basis of cost, number of surveys taken, and available equipment.

No new collection mechanism need be established to gather the data shown in the Demographic Data Report. Ethnic and AFDC data are currently collected in connection with Federal aid programs, and may be routinely entered through preparation of transactions to the Demographic Data File. The data displayed on assessment of school service areas are currently collected and analyzed for the District under a contract to the University of Southern California. They are already in machine-readable form.

AREA 1 COMMUNITY INTEREST PROFILE REPORT DATE:06/15/75
NINETY-SIXTH STREET SCHOOL

QUESTION NUMBER	RESPONDING N	RESPONDING %	1 N	1 %	2 N	2 %	3 N	3 %	4 N	4 %	5 N	5 %
YOUR ESTIMATE OF YOUR CHILDS INTEREST IN MATH												
1	50	50	10	20	25	50	5	10	7	14	3	6
YOUR ESTIMATE OF YOUR CHILDS INTEREST IN SCIENCE												
2	60	60	12	20	35	58	10	18	1	2	2	3

ITEM ANALYSIS

QUESTION	1	2	3	4	5
1	15	14	22	28	21
2	32	12	15	29	12
3	14	37	32	6	11
4	18	22	.8	26	26
5	31	15	23	7	24

Fig. 28--Community Interest Profile

VII. THE INQUIRY SUBSYSTEM

The Inquiry Subsystem is the heart of the information system--the portion upon which its success ultimately depends. Compared with most "management information systems" supporting operations of the size and complexity of the LAUSD, the prototype information system provides very few recurring reports. Too many such systems inundate management with 600-page "daily status reports," which increase rather than decrease administrative workload. The Inquiry Subsystem is the means chosen to give school administrators the information wanted, with a maximum of speed and relevance.

SUBSYSTEM CAPABILITIES

The Inquiry Subsystem is best conceptualized as a question-answerer. The administrator may ask questions of any of the files maintained by the information system, either by telephone, written request, or direct interaction with the computer. He may ask, for example:

- How many secondary mathematics instructors now teaching in Area 1 would prefer to teach in Area 3?
- What are the names of elementary teachers in Area 3, holding a credential to teach, with less than five years of service in the District?
- What classrooms in Area 3 improved reading scores by more than 50 percent from 1970 to 1971?

An inquiry system must also provide the capability for plotting correlations of disparate data. For example:

- Provide a graph showing reading scores of each school against racial composition;
- Provide a graph showing teacher age versus reading-achievement scores for schools in Area 3.

Finally, capability must exist to determine the feasibility and costs of various educational innovations (or necessities):

- o Calculate the cost of placing one Spanish-speaking teacher in every school that does not already have one.
- o Calculate the five-year costs of an educational program having the following characteristics and enrollment: Program A = a_1, a_2, ..., etc.

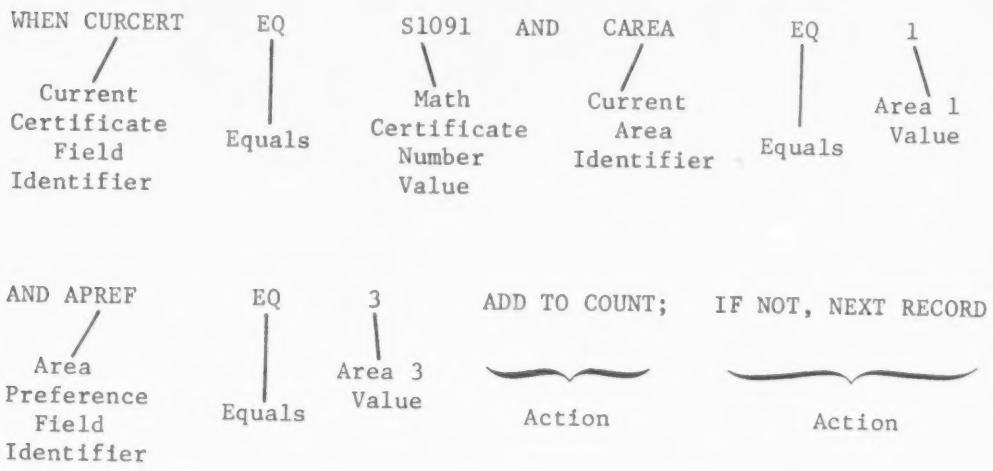
The above questions imply a wide range of search and computational capabilities, from simple look-up of pertinent numerical data to complex statistical analysis and modeling of educational programs. A more detailed discussion of the necessary capabilities is provided below.

File-Inquiry Portion

The file-inquiry process consists of three phases: *formulation*, in which the administrator enters his request; *processing*, in which this request is matched against data files; and *output*, in which the selected data are retrieved. System input and output have been described; processing is done by a file-inquiry program, which reads each record of the pertinent file and examines it for relevance to the question. For example, in answering the question: "How many mathematics teachers now teaching in Area 1 would prefer to teach in Area 3?" the inquiry-processing program would:

1. Enter a record into storage from the personnel file.
2. Examine the field carrying "teaching certificate" to determine if the record is that of a mathematics instructor; if it is not, go to the next record. If it is,
3. Examine the "current area" field to determine if it is equal to Area 1; if it is not, proceed to the next record. If it is,
4. Examine the "location preference" field to determine if it is equal to Area 3; if it is not, proceed to the next record; if it is, add "1" to the final count.

It can be seen that the inquiry package must have a capability for logically describing the requirements for records to be counted or printed. A general inquiry statement must describe the conditions to be met, and the actions to be taken when conditions are or are not met, e.g.,



A variety of file management and inquiry tools exists that can provide the capabilities described above. These include the MARK IV system, supplied by Informatics, Inc.; TS/2 and TDMS, conceived and marketed by the System Development Corporation; and IMS, developed by IBM. Most of these systems operate in a batch mode; a few, however, offer real-time capability. Reference 1 discusses these alternatives in more detail, choosing a package for implementation in the prototype system. The general output examples shown in Fig. 29 are typical products of this class of systems.

Statistical Analysis Portion

A second capability that must be provided through the Inquiry Subsystem is that of analyzing collected data to perceive significant trends, techniques, and educational outcomes. It is expected that educational administrators will require tests of significance, cross-tabulation and correlation-analysis routines, and regression- and

$

PERSONNEL INQUIRY REPORT

REQUESTED BY: F.L. TOGGENBURGER
REPORT DATE: 12/11/75

REQUEST: COUNT ZONE A PERSONNEL WITH CERTIFICATE 8210 AND CERTIFICATE 8213 AND PHD.

COUNT: 27

$

PERSONNEL INQUIRY REPORT

REQUESTED BY: F.L. TOGGENBURGER
REPORT DATE: 12/11/75

REQUEST: LIST ZONE A PERSONNEL WITH CERTIFICATE 8210 AND FIRST ZONE PREFERENCE B, UNLESS YEARS OF SERVICE GREATER THAN 20. PRINT NAME, ADDRESS, CERTIFICATES, PROGRAMS, EDUCATIONAL LEVEL, AND CURRENT LOCATION.

NAME	ADDRESS	CERTIF.	PROGRAM	EDUC. LEVEL	LOCATN
DOE, JOHN A.	...	...	...	...	.
...					

29--Inquiry System Output Examples

$

PERSONNEL INQUIRY REPORT

REQUESTED BY: F.L. TOGGENBURGER
REPORT DATE: 12/11/75

REQUEST: BAR GRAPH DISTRICT PERSONNEL BY YEARS SERVICE, 2-YEAR INTERVALS ON X-AXIS, 200 INTERVALS ON Y-AXIS.

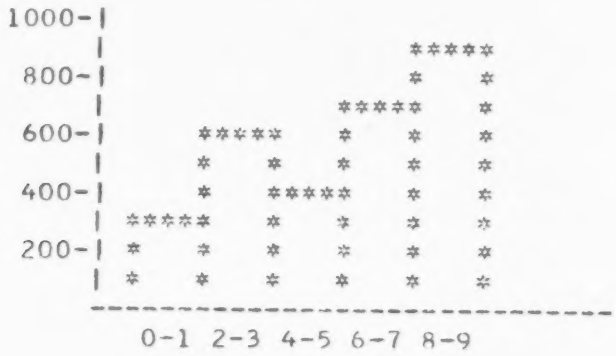


Fig. 29--Continued

factor-analysis programs. These capabilities will allow educators to determine the relative value of particular educational programs in a rigorous, statistically sound manner.

Again, a variety of software packages are available that will provide the capabilities needed. Most major computer manufacturers have produced such packages. In addition, several universities have developed systems for their own use, and are now making these systems available to other educational institutions at a nominal cost. The package chosen for inclusion in the prototype information system must interface directly with the file-inquiry portion. If this is not done, the administrator will have to extract data by inquiry, then reenter the system to perform statistical analyses. Direct interfacing of the

two packages will permit a single request to extract and analyze the data.

An Education Cost Model

The inquiry package detailed above may be described as an interactive aid to the educational decisionmaker. In this general sense, interactive implies two-way communication between man and system, as opposed to the one-way nature of recurring and exception reports. This interactive mode is also used to help the educator prepare his educational program mix (and hence, his budget). For this process, the administrator must be able to rapidly determine the costs of a variety of alternative programs. The information system provides this capability in the form of a cost model. The administrator provides input in eight major areas:

1. Number of students by grade and course in the first year of the planning period.
2. Salary and wage schedules.
3. Standard class size.
4. Paraprofessional-hours per class-hour.
5. Course-grade-subject probability matrix.
6. Student attrition by grade and course.
7. Teacher-equivalent hours per week.
8. Material and equipment cost factors.

In return, the administrator receives a detailed breakdown of the costs of such a set of programs. The model should provide output in three separate categories: total cost estimates by major program area, total cost estimates by standard budget category, and program cost by budget category (similar to the two budget crosswalk reports shown in Fig. 12, p. 28).

The model itself is simply a set of cost-estimating equations. These equations (in most cases derived empirically from actual school experience) are used to relate the various input factors to produce

detailed, categorical, multiyear costs. Unlike the file inquiry and statistical packages, few program-cost models are available. One effective package that provides the capabilities described is the California Educational Cost Model (CALECOM), prepared by The Rand Corporation for the State Department of Education.

Figure 30 shows the information flow of the Inquiry Subsystem. The final shape of this subsystem will be determined by the hardware configuration chosen for prototype implementation. Alternatives range from an all-mail system, with inquiries and answers transmitted by District couriers, to a full on-line system that allows administrators to query files and model educational programs in close interaction with the information system.

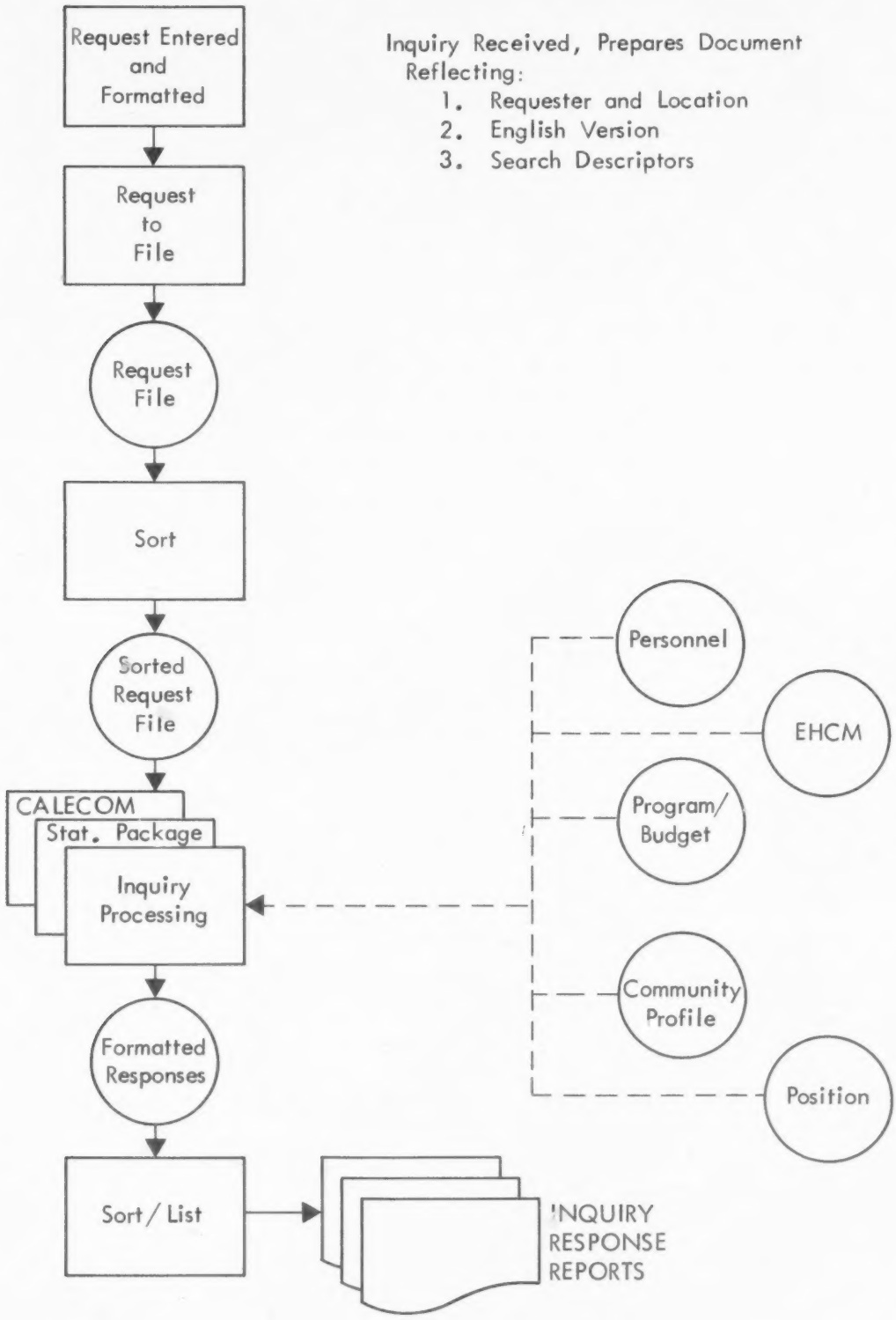


Fig. 30--Inquiry System

REFERENCES

1. Farquhar, J. A., I. M. Iwashita, and S. H. Landa, *An Information System for Educational Management, Vol. V: A Design for Implementation*, The Rand Corporation, R-934-LACS, December 1971.

2. Rapp, M. L., *An Information System for Educational Management, Vol. II: Data Requirements for Accountability*, The Rand Corporation, R-931-LACS, December 1971.

3. Farquhar, J. A., and B. W. Boehm, *An Information System for Educational Management, Vol. I: Design Considerations*, The Rand Corporation, R-930-LACS, December 1971.

4. Donaldson, T. S., *An Information System for Educational Management, Vol. III: Data Requirements for Evaluation; A Review of Educational Research*, The Rand Corporation, R-932-LACS, December 1971.